Appendix F:
Photo Interpretation Mapping Conventions And Visual Key

USGS-NPS Vegetation Mapping Program
Voyageurs National Park, Minnesota

USGS
science for a changing world

Introduction

This document is a photo interpretation and visual key to map units for the Voyageurs National Park Vegetation Mapping Project. Its purpose is to:

- Provide a ground photo image for each map unit;
- Describe the link between each map unit and the U.S. National Vegetation Classification (USNVC);
- Provide visual examples of each map unit with aerial photographs and delineated overlays;
- Provide descriptions for the visual examples;
- Provide an area report for each map unit;
- Provide accuracy assessment results for each map unit.

This key does not attempt to show an exhaustive representation for all variations within each map unit; only the most common or significant representations are included herein. These should be sufficient to give the user a feel for the imagery and an understanding of the relationships between classification and mapping.

Organization to the Photo Interpretation Visual Key

This key presents descriptions and illustrations for every map unit used in the Voyageurs National Park Vegetation Mapping Project. Each map unit is presented in a uniform format on two to three pages. Each map unit section begins with a presentation of the map unit name and a representative ground photo of the map unit if available. A paragraph below the ground photo describes the link between the map unit and the vegetation association(s) within the USNVC. A general description is given of the vegetation association(s). For detailed descriptions of vegetation associations, refer to Section 6 of the main report, *Vegetation Descriptions of Voyageurs National Park*. Several 2 x 2-inch aerial photograph images follow. The images are scanned portions of the 1995 and 1996 color infrared (CIR) aerial photograph prints with the matching transparent interpreted overlays (Figure 1 of this document). These 2 x 2-inch images are of the same scale (1:15,840) as the aerial photographs. Each image reveals the photo interpreter's inked polygon outlines and map codes. A map code is made up of a map unit code (e.g. RP) and physiognomic modifiers if applicable (e.g. -1A2). The featured polygon is identified with the map code and a line pointing to it. The bottom left corner gives the date of photograph (month-year) and an approximate geographic location. With each image, a short explanation describes the map unit and its physiognomic modifier of the featured polygon. This description includes color(s) and texture(s), and when applicable, the coverage density and pattern, and height of the vegetation. Other information about the map unit or the polygon is also presented if it adds to better understanding or recognition of that particular map unit.

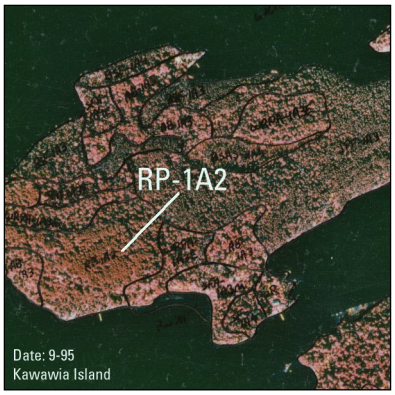


Figure 1. Image of aerial photo with interpreted overlay

Lastly, each map unit has an area report and results of the accuracy assessment. The area report includes the number of polygons, hectares, acres, and the average size. This information is also presented in the main report (Table 6). Accuracy assessment results for producers' and users' accuracy and the confidence intervals are also given. For map units where producers' or users' accuracy fall below the 80% standard, a general explanation is usually given identifying the primary error. Detailed information on the types of errors that occurred for any given map unit are presented in the main report (Table 7).

The map units are arranged according to ecological groups, that is, groups of types that share similar ecological processes (Faber-Langendoen 2000, in press). Twelve ecological groups were used to organize the types at Voyageurs, 6 wetland groups and 6 upland groups. These groups highlight the ecological diversity found at Voyageurs.

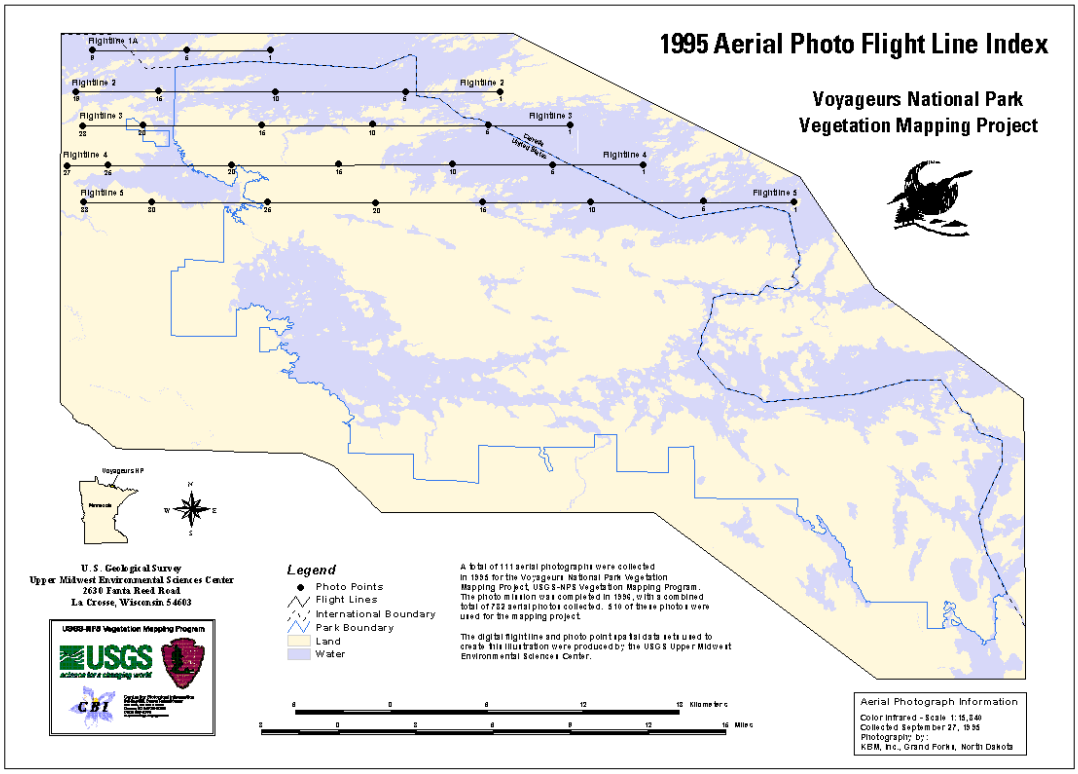
Aerial Photographs

KBM, INC (1604 S. Washington St., Grand Forks, ND 58201-6334) collected aerial photographs for a portion of the northern one-third of project on September 27, 1995. The remaining area was collected in 1996 (September 13, 14, and October 3). The photos were taken at a flight altitude of 7,920 feet above sea level with a Jena Link 15/2323 camera using Kodak Aerochrome Infrared 2443 film. The photo mission was designed to take photos with about 30% side lap (between each flight line) and 60% overlap (along each flight line). The scale of the CIR 9 x 9-inch transparencies is 1:15,840 (approximately 4 inches to one mile). Two sets of contact prints were produced from the transparency set (Figure 2). A total of 782 photos along 20 flight lines were collected. The photo mission covered the entire project area, which includes the entire park and environs (Figure 3). Only 509 of these photos were necessary to map the defined project area. The photo transparency set was used to interpret vegetation and land cover types using a stereoscope over a light table. The photo print sets were used for field reconnaissance, vegetation data collection, and map automation. An existing set of CIR photo prints, taken in the fall of 1988 at a scale of 1:12,000, were used as collateral information (see section 2.7 *Photo Interpretation* in the main report).

Figure 2. Example of an aerial photograph
(*example is not to scale*)

Color Infrared Film (CIR)

Vegetation reflects more infrared than visible light, and this helps subtle differences in physical characteristics of species to show up as large differences on CIR film. CIR imagery presents a "false color" picture that combines infrared reflectance with green and red visible bands. The differences in reflectance create differences in color that allow the photo interpreter to see the distinguishing features of different plant species and vegetation communities. Reflectance is influenced by structure of the canopy, the orientation of the plants and their leaves, and the thickness and pigment content of leaves. For example, needle foliage of conifers creates internal shadows and the leaves themselves reflect less infrared radiation than hardwoods. This gives them a darker appearance in the CIR than hardwoods such as oak and aspen (Hershey and Befort 1995).



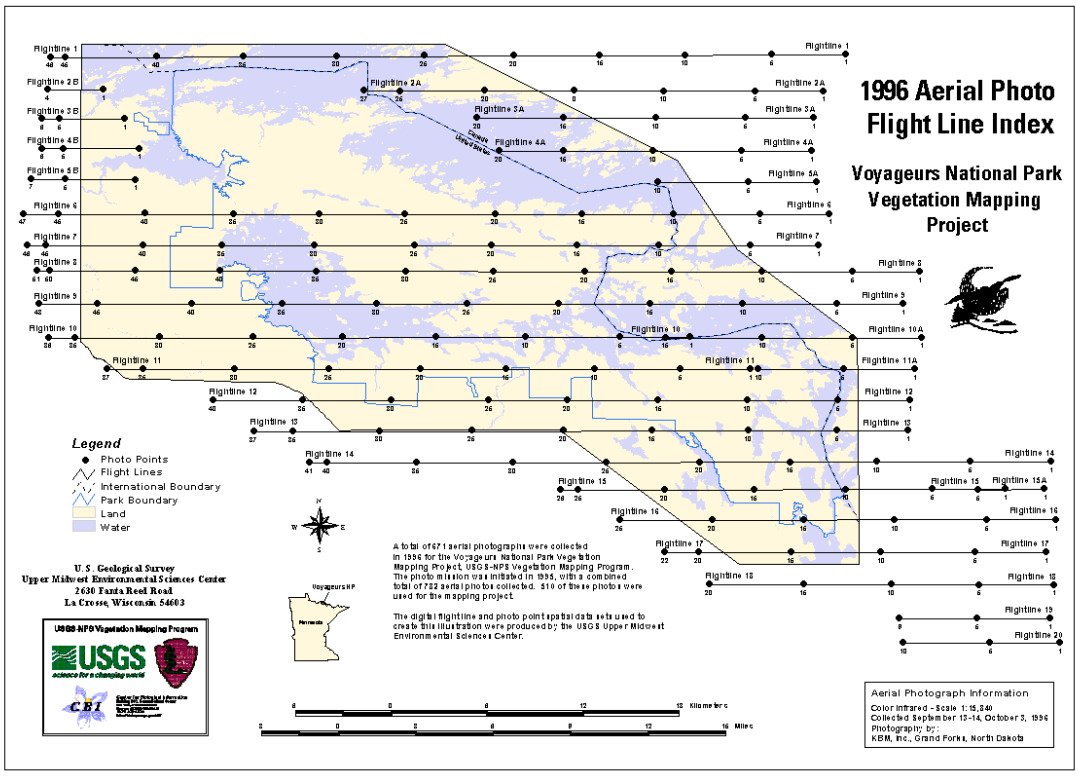


Figure 3. 1995 and 1996 Aerial Photographs of Voyageurs NP and Environs

Texture is also important to the photo interpreter for identification. For trees, texture is influenced by type and orientation of leaves, crown size and shape, and branch structure. An uneven canopy height will appear more broken than an even canopy. Similarly, trees having small crowns will appear a finer texture than trees that have large crowns. Depending on the tree species, the texture can be rough or smooth, fine, lacy, billowy, compact, or any number of other descriptors. These are imprecise terms, but nonetheless important visual elements of the imagery. In contrast, herbaceous vegetation, including wetland and upland communities, generally tend to appear much smoother in texture than forests or woodlands (Hershey and Befort 1995).

Color infrared photography is not consistent enough to allow a species or type to be described precisely. Film batch, printing process, sun angle, light intensity, shadow, and exposure can all affect the appearance of CIR photography (Hershey and Befort 1995). Thus, ground verification of every set of photos is imperative to successful interpretation.

The U.S. National Vegetation Classification

The U.S. National Vegetation Classification (USNVC) is a vegetation-based system that emphasizes natural and existing vegetation. The Nature Conservancy and the Natural Heritage Programs in North America developed the system out of conservationists needs to move from strategies focused on endangered species to a more comprehensive approach based on ecological communities. A standardized national classification of ecological communities was needed to implement such a strategy (Grossman et al. 1998). The system uses a combined physiognomic-floristic hierarchy. Table 1 of this document provides an example of the classification hierarchy.

Table 1. The USNVC's Physiognomic-floristic Hierarchy for Terrestrial Vegetation (from Grossman et al. 1998).

Level	Primary Basis For Classification	Example
Class	Growth form and structure of vegetation	Woodland
Subclass	Growth form characteristics, e.g., leaf phenology	Deciduous Woodland
Group	Leaf types, corresponding to climate	Cold-deciduous Woodland
Subgroup	Relative human impact (natural/semi-natural or cultural)	Natural/Semi-natural
Formation	Additional physiognomic and environmental factors, including hydrology	Temporarily Flooded Cold-deciduous Woodland
Alliance	Dominant/diagnostic species of uppermost ordominant stratum	Populus deltoides Temporarily Flooded Woodland Alliance
Association	Additional dominant/diagnostic species from any strata	*Populus deltoides – (Salix amygdaloides) / Salix exigua* Woodland

Vegetation Map Units and Their Link to the USNVC

Vegetation map units presented in this document are those defined by the mapping and ecological teams from the U.S. Geological Survey Upper Midwest Environmental Sciences Center and The Nature Conservancy (see section 2.5 *Creation of Map Units* in the main report). Many of the map units crosswalk to the USNVC at the association level, but a few do not. The USGS-NPS Vegetation Mapping Program promotes mapping at the finest level of the USNVC (the association level) when possible. However, not all important vegetation distinctions are visible on the photos through interpretation. Environmental conditions or diagnostic species that distinguish closely related types are often not discernible on the imagery. Thus, some map units are aggregates of vegetation associations and do not have a one-to-one relationship with USNVC's finest level.

In some instances, the imagery reveals different signatures for a single association. For example, the Black Spruce / Labrador Tea Poor Swamp Association may have a canopy composed primarily of black spruce in some stands, or may have black spruce sharing dominance with tamarack in other stands. The imagery reveals differences in the canopy dominance, so before the classifiers decided that this was one association, the photo interpreters mapped them separately. These map units are called phases of an association. They are not phases from a classification perspective, only from a mapping perspective. For a complete description of the relationships between vegetation map units and the vegetation associations see section *3.4 Map Units* in the main report.

Table 2 lists these vegetative map units and their relationship to the USNVC under the *Natural/Semi-natural Vegetation Map Units* section.

Other Map Units

Several map units were derived to describe ground features that do not meet the criteria for USNVC Natural/Semi-natural Vegetation. These map units represent Planted/Cultivated Formations within the USNVC (such as evergreen plantation and hayland/pastureland), and land use/land cover (LUC) classes (such as agricultural land, urban land, and water that is >16 h and <10% vegetated), were are derived from Level II of *A Land Use and Land Cover Classification System for Use with Remote Sensor Data* (Anderson et al. 1976). In addition, map units were created to map small upland islands that fall below the standard minimum mapping unit of 0.5 h. An exception was made to map these islands to 0.1 h. Using the USNVC to map the vegetation of these islands is not ideal from either a field or a photo perspective. Last, map units for bodies of water that are <10% vegetated and are <16 h in size were created to map 2 kinds of small natural ponds. Because of limitations in seeing submergent vegetation with CIR aerial photographs, some of these small ponds may indeed have >10% vegetation. In the case of error, it is recommended that these would best be described with the Midwest Pondweed Submerged Aquatic Wetland Association. Table 2 lists these map units and their relationship to the USNVC under the *Planted/Cultivated, Land Use/Land Cover, and Park Specific Map Units* section.

Table 2. Map units and related levels within the U.S. National Vegetation Classification or Anderson (1976) for Voyageurs National Park. Map codes are organized by Ecological Groups.

MAP UNIT CODE	MAP UNIT NAME	LEVEL
Natural/Semi-natural Vegetation Map Units		
Bogs		
Treed Bogs		
BSB	Black Spruce Bog	Association
Shrub Bogs		
LBC	Black Spruce/Leatherleaf Semi-treed Bog	Association
LB	Leatherleaf Bog	Association
BBX	Beaver Basin Break-up Mosaic	Map Unit
Northern Shrub and Graminoid Fens		
Shrub Fens		
BBSF	Bog Birch-Willow Shore Fen	Association
LSF	Leatherleaf-Sweet Gale Shore Fen	Association
TF	Tamarack Scrub Poor Fen	Association
Graminoid Fens		
SPF	Northern Sedge Poor Fen	Association
Wet Meadows		
BJ	Canada Bluejoint Eastern Meadow	Association
SMX	Wet Meadow/Fen Mosaic/Complex	Map Unit

MAP UNIT CODE	MAP UNIT NAME	LEVEL
Marshes		
Emergent Marshes		
PM	Eastern Reed Marsh	Association
BM	Freshwater Bulrush Marsh	Association
CM	Midwest Cattail Deep Marsh	Association
WRM	Wild Rice Marsh	Association
DMX	Deep Marsh Mosaic/Complex	Map Unit
Rooted and Floating Aquatic Marshes		
PW	Midwest Pondweed Submerged Aquatic Wetland	Association
WL	Northern Water Lily Aquatic Wetland	Association
Northern Conifer and Hardwood Swamps		
Rich Hardwood Swamps		
BA	Black Ash-Mixed Hardwood Swamp	Association
WCBA	White Cedar-Black Ash Swamp	Association
Rich Conifer Swamps		
BSAS	Black Spruce/Alder Rich Swamp	Association
TA	Northern Tamarack Rich Swamp	Association
WCS	White Cedar-(Mixed Conifer)/Alder Swamp (rich soil phase)	Association
WCT	White Cedar-(Mixed Conifer)/Alder Swamp (peatland phase)	Association
Poor Conifer Swamps		
BSL	Black Spruce/Labrador Tea Poor Swamp (evergreen phase)	Association
BST	Black Spruce/Labrador Tea Poor Swamp (mixed phase)	Association
Northern Shrub Swamps		
DS	Dogwood-Pussy Willow Swamp	Association
AS	Speckled Alder Swamp	Association
Rock Barrens		
Treed Rock Barrens		
JPW	Boreal Pine Rocky Woodland (jack pine phase)	Association
JPM	Boreal Pine Rocky Woodland (mixed pine phase)	Association
JPL	Jack Pine/Lichen Rocky Barrens	Association
ABW	Mixed Aspen Rocky Woodland	Association
OW	Northern Pin Oak-Bur Oak-(Jack Pine) Rocky Woodland (deciduous phase)	Association
JPOM	Northern Pin Oak-Bur Oak-(Jack Pine) Rocky Woodland (jack pine-oak phase)	Association
MPHW	Northern Pin Oak-Bur Oak-(Jack Pine) Rocky Woodland (mixed pine-oak phase)	Association
Shrub and Herb Rock Barrens		
UBS	Boreal Hazelnut-Serviceberry Rocky Shrubland	Association
MGF	Poverty Grass Granite Barrens	Association
Northern White Cedar-(Hardwood) Forests		
WCU	White Cedar-Boreal Conifer Mesic Forest	Association
WCA	White Cedar-Yellow Birch Forest	Association
Northern Pine-(Hardwood) Forests		
JPAX	Jack Pine-Aspen Forest Mosaic	Map Unit
JPF	Jack Pine/Balsam Fir Forest	Association
WRPA	White Pine-Red Pine-Quaking Aspen-Birch Forest	Alliance
RP	Red Pine/Blueberry Dry Forest	Association
WP	White Pine/Mountain Maple Mesic Forest	Association
Northern Spruce-Fir-(Hardwood) Forests		
SFA	Spruce-Fir-Aspen Forest	Alliance
BSF	Black Spruce/Feathermoss Forest	Association
SF	Spruce-Fir/Mountain Maple Forest	Association

MAP UNIT CODE	MAP UNIT NAME	LEVEL
Boreal Hardwood Forests		
AB	Quaking Aspen-Paper Birch Forest	Alliance
PB	Paper Birch/Fir Forest	Association
AL	Trembling Aspen-Balsam Poplar Lowland Forest	Association
Northern Hardwood Forests		
BO	Northern Bur Oak Mesic Forest	Association
	Planted/Cultivated, Land Use/Land Cover, and Park Specific Map Units	
Planted/Cultivated Vegetation (USNVC)		
EP	Evergreen Plantation	Formation
PGCH	Perennial Grass Crops (hay, pastureland)	Formation
PGCS	Perennial Grass Crops with Sparse Shrubs (hay, pastureland)	Formation
Land Use/Land Cover (USGS - Anderson Level II)		
Developed Lands		
ACP	Cropland and Pasture	LUC II
ARB	Other Agricultural Land	LUC II
BLQ	Strip Mines, Quarries, and Gravel Pits	LUC II
UC	Commercial and Services	LUC II
UR	Residential	LUC II
UT	Transportation, Communications, and Utilities	LUC II
Lakes and Streams		
WLK	Lakes (>16 h)	LUC II
WS	Streams and Canals	LUC II
Small Islands and Natural Ponds (Park Specific)		
Small Islands		
SIG	Small Island with Grass (0.1 - 0.5 h)	Park
SIR	Small Island with Rock (0.1 - 0.5 h)	Park
SIS	Small Island with Shrubs (0.1 - 0.5 h)	Park
SIT	Small Island with Trees (0.1 - 0.5 h)	Park
Small Natural Ponds		
WBP	Water-Beaver Pond (<10% vegetated)	Park
WNP	Water-Natural Pond (<16 h, <10% vegetated)	Park

Photo Interpretation

Preparation of the aerial photographs for interpretation follows procedures of Owens and Hop (1995). The 1995 and 1996 CIR film transparencies were cut from rolls and covered with clear acetate overlays. The overlays were registered to the transparency photos and subsequently labeled with flight line and photo numbers.

Field reconnaissance was performed to learn, test, and verify photo signatures of vegetation types and other non-vegetated features (land use/land cover) and to establish a map classification. Once mapping protocols were established, photo interpretation and mapping proceeded.

Photo interpretation was performed using the 1995 and 1996 photo transparencies. Ground features were interpreted, and subsequently were delineated and labeled with map unit codes onto the photo overlays using a Bausch and Lomb Zoom 240 stereoscope over a light table. Each transparency photo was viewed with its matching stereo pair (adjacent photo) so images could be seen in 3-dimensions. To minimize edge distortion, interpretation was focused towards the center of each aerial photograph.

Texture, height, color, pattern, life form, and position in the landscape were all used in the decision making process of delineating polygons and assigning map unit codes. In addition to photo signature characteristics, the photo interpreter's knowledge of the environmental distribution of the types was used to help confirm the identity of the signatures. A standard minimum mapping unit of 0.5 h was applied. Small upland islands were mapped to 0.1 h. 509 aerial photographs of the 1995/1996 set were interpreted for the project.

With mapping vegetation types, a polygon is delineated to define a particular vegetation type. The polygon is attributed with a map unit code that represents the vegetation type. Conventionally, a polygon is not sub-divided because of physiognomic structural changes with the vegetation (e.g. density, height). However, extensive structural changes (e.g. large blowdown areas) within a map unit polygon were delineated separately. To attribute the physiognomic structure of the vegetation, a systematic string of modifier codes (see attribute section below) were added to map unit code (Table 2, e.g. DMX-2B, BA-1A4, WRPA-1A2M). Physiognomic modifiers are added (when applicable) to all vegetation map units.

During the onset of mapping, other maps were used to gain familiarity with vegetation characteristics. A map of Kabetogama Lake [*1988 Vegetation of the Kabetogama Peninsula, Minnesota. Unpublished map (1:24,000), Natural Resources Research Institute, Duluth, Minnesota. Funded by National Science Foundation Grant DEB-9119614]* and National Wetlands Inventory 7.5-minute quadrangle maps (U.S. Fish and Wildlife Service, St. Petersburg, Florida) were especially useful during the initial stages of photo interpretation.

Throughout the entire interpretation process, October 1988 CIR photographs were also viewed to better determine vegetation types. The 1988 photos, because they effectively captured fall colors in leaf canopies, were very helpful in revealing various distinctions not apparent on the 1995 and 1996 photographs. The primary characteristic that differed was that of color. Where changes in the vegetation occurred between the two sets of photographs, only characteristics on the recent set were used to determine the types.

Attribute Conventions for Map Unit & Physiognomic Modifier Codes

Through the process of interpreting the aerial photographs, polygons were delineated to capture the position of vegetation communities (USNVC types, as discussed previously) and land use/land cover features (such as roads and non-vegetated lakes). To attribute these polygons, map unit and physiognomic modifier codes were used for technical mapping purposes. The map unit codes represent the vegetation types and land features, and the physiognomic modifier codes represent the growth structure of the vegetation within a mapped polygon. These codes were later joined with a database table containing the definitions of these codes, thus incorporating the definitions into the spatial map. Descriptions to map unit codes and physiognomic modifier codes are listed on Tables 2 and 3 respectively of this document.

The following briefly explains the conventional practice for polygon attribution. The format uses a combination of alternating alpha and numeric codes. The result is a string of codes to describe in detail the features of a mapped polygon.

The attribute code begins with the **map unit code**, which represents either a vegetation type(s) or a land use/land cover feature. The map unit code is made up of 2 to 4 **alpha** characters. *Examples:*

WRPA, **JPW**, **DS**, **LB**, **CM**, **UR**

A series of **physiognomic modifier codes** follow the map unit code when applicable. A **hyphen** is placed between the map unit code and the string of physiognomic modifier codes. All vegetation map unit codes (codes describing USNVC types) receive physiognomic modifiers. *Examples:*

WRPA-, JPW-, DS-, LB-, CM-

The first physiognomic modifier code represents **Coverage Density**. It describes the coverage (a percent range) of the vegetation type that the map unit is representing within the polygon. Typically, the modifier defines the coverage of the higher plant life form (e.g. density of tree canopy, not density of tree canopy and shrub layer). The modifier is a single **numeric** code. All vegetation map unit codes receive this modifier. *Examples:*

WRPA-**1**, JPW-**2**, DS-**2**, LB-1, CM-**1**

The second physiognomic code represents **Coverage Pattern**. It describes the pattern or distribution of the vegetation type that the map unit is representing within the polygon. Like the density modifier, the pattern modifier typically defines the growth pattern of the higher plant life form. This modifier is a single **alpha** code and follows the Coverage Density numeric code. All vegetation map unit codes receive this modifier. *Examples:*

WRPA-1**A**, JPW-2**B**, DS-2**C**, LB-1A, CM-1**C**

The third physiognomic code represents **Height**. It describes the average height of the woody terrestrial vegetation type that the map unit is representing within the polygon. In forest and woodland cases where a super-canopy exists of >25% cover, the modifier describes the height of the super-canopy tree (to indicate age of stand) and not the average height of all trees. There is no representation within the map code of whether the height is indicative of average or supra-canopy. The modifier is a single **numeric** code and follows the Coverage Pattern alpha code. Only map units representing vegetation types under the USNVC Forest, Woodland, Shrubland, and Dwarf-shrubland Formation Classes receive this modifier. *Examples:*

WRPA-1A**2**, JPW-2B**4**, DS-2C**5**, LB-1A**6**

The last physiognomic modifier code represents **Dominance/Co-dominance**. It describes the degree of mixes between evergreen and deciduous trees (and shrubs for some woodland types) within a polygon. The modifier is a single **alpha** code and follows the Height numeric code. All map units representing vegetation types under the USNVC Mixed Evergreen - Deciduous Forest Formation Subclass receive this modifier. In addition, the BST & WCT map units (deciduous mixed phases of true evergreen forest types), and the MPHW* & JPOM map units (evergreen mixed phases of a true deciduous woodland type) are the exceptions. Throughout the mapping process, the vegetation types represented by these map units were thought to be true mixed evergreen-deciduous vegetation types. After further analysis of vegetation data, it was determined that these vegetation types were actually phases of either true evergreen or deciduous forest or woodland types. The modifiers were retained to provide additional information about the vegetation and polygon. *Examples:*

WRPA-1A2**E**, BST-1A4**M**, MPHW-2B4**D**

* all MPHW-XXXE codes were globally changed to another map unit code (JPM-XXX)

Table 3. Key to Physiognomic Modifier Codes

Coverage Density (all vegetation map units)
1 - Closed Canopy/Continuous (60-100% coverage)
2 - Open Canopy/Discontinuous (25-60% coverage)
3 - Dispersed-Sparse Canopy (10-25% coverage)
Coverage Pattern (all vegetation map units)
A - Evenly Dispersed
B - Clumped/Bunched
C - Gradational/Transitional
D - Regularly Alternating
Height (forest, woodland, shrubland, & dwarf-shrubland map units)
1 - 30-50 meters (98-162 feet)*
2 - 20-30 meters (65-98 feet)
3 - 12-20 meters (40-65 feet)
4 - 5-12 meters (16-40 feet)
5 - 0.5-5 meters (1.5-16 feet)
6 - <0.5 meters (<1.5 feet)
Dominance/Co-dominance (forest & woodland map units, evergreen-deciduous mix)
D - Deciduous dominant 60-75%, evergreen 25-40%
E - Evergreen dominant 60-75%, deciduous 25-40%
M - Deciduous/Evergreen co-dominant, each 40-60%
** Height code "1" was not used for VOYA vegetation mapping*

BSB - Black Spruce Bog

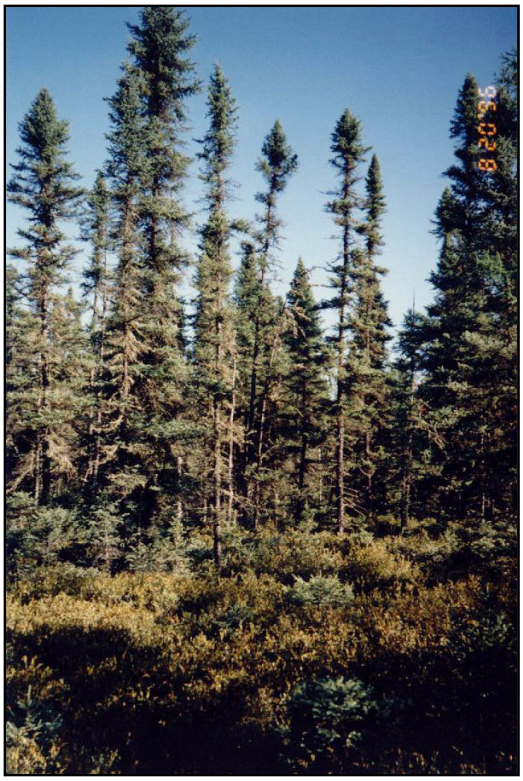
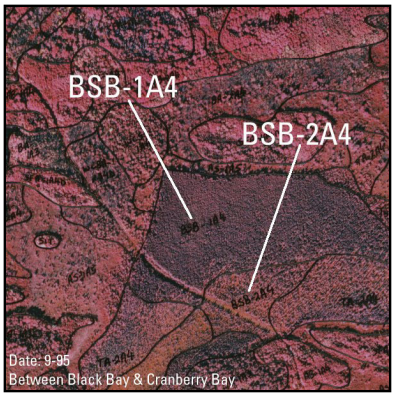


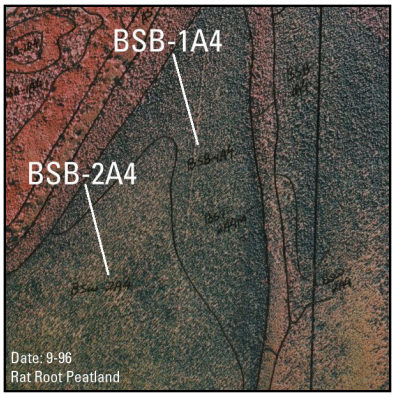
Photo credit: Kevin Hop

Photo credit: Kevin Hop

The Black Spruce Bog Map Unit (BSB) represents the Black Spruce Bog Association. This association is found in the Rat Root River Peatland area and in the peatland complex between Black Bay and Cranberry Bay. BSB is found in situations removed from ground and surface water inputs. Sphagnum peat forms a deep substrate. Black spruce dominates this association.



BSB-1A4 appears as dark magenta and purple with a fine mottled texture. The canopy is closed and evenly dispersed. The tree height falls within the 5-12 meter range. BSB-2A4 is dark purple mottled with orange mats of ericaceous dwarf-shrubs and Sphagnum moss within the understory. The canopy is open and evenly dispersed. The photo was taken in September 1995.



BSB-1A4 appears as dark green and olive with a pebbly texture. The canopy is closed and evenly dispersed. The tree height falls within the 5-12 meter range. BSB-2A4 is similar, but the canopy is open, revealing orange flecks of the ericaceous dwarf-shrubs and Sphagnum moss within the understory. The photo was taken in September 1996.

BSB - Black Spruce Bog

BSB-1A4 appears as dark green with a fine mottled texture. BSB-2A4 has flecks of orange where the ericaceous dwarf-shrubs and Sphagnum moss are revealed due to the more open canopy. The photo was taken in September 1996.

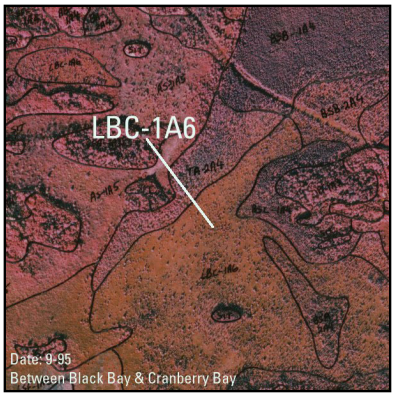
Area Report for BSB Map Unit
Polygons: 25
Hectares: 761
Acres: 1,879
Average Size: 30 hectares, 75 acres

Accuracy Assessment Results for BSB Map Unit
The Black Spruce Bog Map Unit was assessed at 95% for producers' accuracy (confidence interval 85-105%) and at 100% users' accuracy (confidence interval 98-103%).

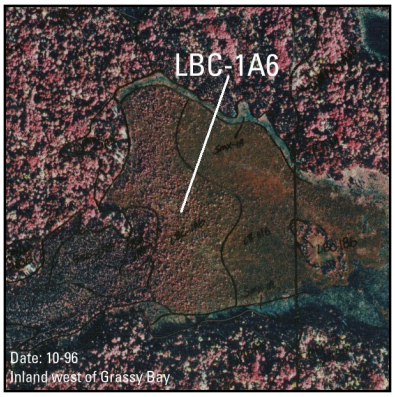
LBC - Black Spruce/Leatherleaf Semi-treed Bog

Photo credit: Kevin Hop

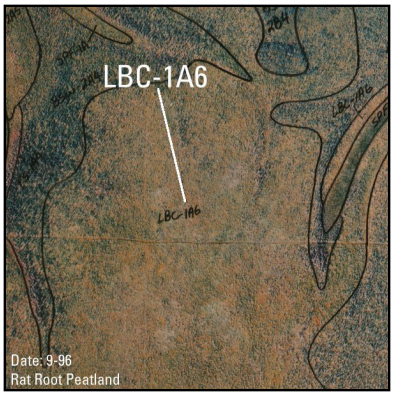
The Black Spruce/Leatherleaf Semi-treed Bog Map Unit (LBC) represents the Black Spruce / Leatherleaf Semi-treed Bog Association. This association occurs throughout the park and is extensive in the Rat Root Peatland. It occurs in confined basins, as part of large peatlands, and as part of peatland shores away from the water's edge. The substrate is deep fibric Sphagnum peat. Black spruce and/or tamarack are the dominant conifers, which occur at <25% canopy cover. Leatherleaf is the dominant dwarf-shrub layer. This association is also mapped as part of the BBX map unit when it occurs in inundated beaver complexes.



LBC - Black Spruce/Leatherleaf Semi-treed Bog



LBC-1A6 appears as dark red and brown with a grainy texture. The dwarf-shrubs form a continuous cover and are evenly dispersed throughout the polygon. The height of the dwarf-shrubs is <0.5 meters. The photo was taken in October 1996.



LBC-1A6 appears as orange and tan with speckles of dark olive-green and mottled in texture. The dwarf-shrubs, primarily leatherleaf and Sphagnum mosses, form a carpet and contribute to the orange color. The darker specks are the scattered conifers. The photo was taken in September 1996.

Note: the physiognomic modifiers reflect the dwarf-shrub layer of LBC, and not the tree layer.

Area Report for LBC Map Unit
Polygons: 212
Hectares: 1,703
Acres: 4,208
Average size: 8 hectares, 20 acres

Accuracy Assessment Results for LBC Map Unit
The Black Spruce/Leatherleaf Semi-tree Bog Map Unit was assessed at 88% for producers' accuracy (confidence interval 74-101%) and 75% for users' accuracy (confidence interval 60-90%). Producer's accuracy is considered adequate as mapped. Errors in users' accuracy were primarily associated with Map Units BSL/BST and LB.

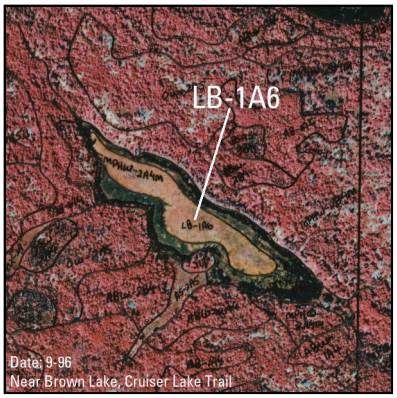
LB - Leatherleaf Bog

Photo credit: Michael Lew-Smith

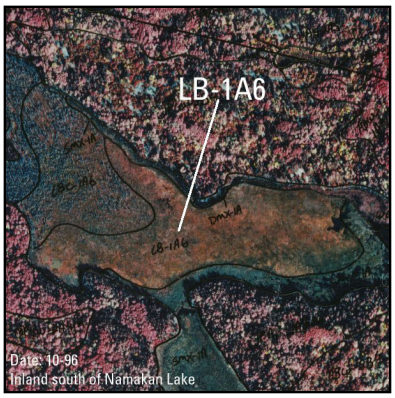
The Leatherleaf Bog Map Unit (LB) represents the Leatherleaf Bog Association. This association occurs throughout the park in confined basins, as part of large peatlands, and as part of shoreline complexes. The substrate is deep fibric Sphagnum peat, which is mineral poor. An ericaceous dwarf-shrub layer, primarily Leatherleaf, dominates this community. This association is also mapped as part of the BBX map unit when it occurs in inundated beaver complexes.

LB-2A6 appears as orange and green with a slightly mottled texture. The dwarf-shrub coverage is discontinuous and evenly dispersed throughout the polygon. The height of the dwarf-shrubs is <0.5 meters. The photo was taken in September 1995.

LB - Leatherleaf Bog



LB-1A6 is light orange and deep yellow, and spots of tan and olive-green, all with a relatively smooth texture. A moat-like ring of water surrounds the LB polygon. The photo was taken in September 1996.



LB-1A6 appears as mottled orange and brown. The dwarf-shrub coverage is continuous and evenly dispersed. The height of the dwarf-shrubs is <0.5 meters tall. The photo was taken in October 1996.

Area Report for LB Map Unit
Polygons: 297
Hectares: 892
Acres: 2,205
Average size: 3 hectares, 7 acres

Accuracy Assessment Results for LB Map Unit
The Leatherleaf Bog Map Unit was assessed at 73% producers' accuracy (confidence interval 58-88%) and 85% users' accuracy (confidence interval 71-98%). Errors in producer's accuracy were primarily associated with Map Units LBC and BBSF. Users' accuracy is considered adequate as mapped.

BBX - Beaver Basin Break-up Mosaic

The Beaver Basin Break-up Mosaic Map Unit (BBX) represents 6 associations: Leatherleaf Bog, Black Spruce / Leatherleaf Semi-treed Bog, Leatherleaf - Sweet Gale Shore Fen, Northern Sedge Wet Meadow, Northern Water Lily Aquatic Wetland, and Midwest Pondweed Submerged Aquatic Wetland. These associations often occur in a spatial pattern too intricate to map individually, occurring where beaver activity has caused a break up of an ericaceous dwarf-shrub mat. The mat becomes partly flooded, creating pockets of wet sedges or in deeper zones, water lilies and pondweeds. A polygon mapped as BBX includes at least one dwarf-shrub and one herbaceous association.

BBX appears as a varied signature. The dwarf-shrubs and sedges appear as orange and green in the center of the polygon. The light pink is floating herbaceous vegetation. The coverage of the dwarf-shrub mat is discontinuous and evenly dispersed. The height of the mat is <0.5 meters.

BBX appears primarily as an orange signature with greenish edges. The mat is partly inundated with surrounding water. The orange signature is the dwarf-shrub mat. The green edges and darker signatures are herbaceous. The dwarf-shrub mat is discontinuous and clumped. The photo was taken in October 1996.

Note: the physiognomic modifiers reflect the dwarf-shrub layer of BBX, and not the herbaceous layer.

Area Report for BBX Map Unit
Polygons: 29
Hectares: 71
Acres: 176
Average size: 2 hectares, 6 acres

Accuracy Assessment Results for BBX Map Unit
The Beaver Basin Break-up Mosaic Map Unit was assessed at 100% producers' accuracy (confidence interval 75-125%) and 100% users' accuracy (confidence interval 75-125%).

BBSF - Bog Birch-Willow Shore Fen

Photo credit: Michael Lew-Smith

The Bog Birch-Willow Shore Fen Map Unit (BBSF) represents the Bog Birch - Willow Shore Fen Association. This association is commonly found along the minerotrophic margins of large peatlands, confined basin peatlands, or peatland lakeshore complexes. However, the map unit was applied only to peatland lakeshore complexes. The substrate is deep fibric Sphagnum peat. The water regime is saturated, and hummock and hollow microtopography is well developed. The shrub layer is dominated by bog birch; however, alder and willows are common.

BBSF-1A5 appears as olive-green and orange with a light yellow overcast. The texture is slightly rough and mottled. The bog birch is light yellow and dull olive-green and the Sphagnum mosses and ericaceous dwarf-shrubs are orange with deeper olive-green. The bog birch forms a continuous canopy and is evenly dispersed. The height of the shrubs falls within the 0.5-5 meter range. The photo was taken in September 1995.

BBSF - Bog Birch-Willow Shore Fen

Area Report for BBSF Map Unit
Polygons: 51
Hectares: 238
Acres: 588
Average Size: 5 hectares, 12 acres

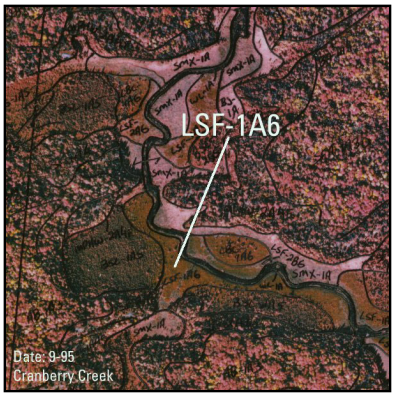
Accuracy Assessment Results for BBSF Map Unit
The Bog Birch Willow Shore Fen Map Unit was assessed at 95% producers' accuracy (confidence interval 84-106%) and 83% users' accuracy (confidence interval 67-98%).

LSF - Leatherleaf-Sweet Gale Shore Fen

Photo credit: Kevin Hop

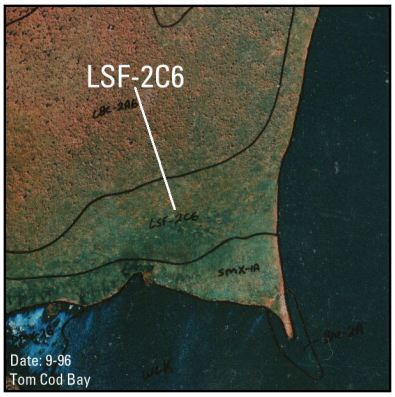
The Leatherleaf-Sweet Gale Shore Fen Map Unit (LSF) represents the Leatherleaf - Sweet Gale Shore Fen Association. This association occupies peatland sites that receive minerotrophic influence from stream or lake water. When near the water's edge, the peat may be floating. Substrate is deep, fibric Sphagnum peat and the water regime is seasonally flooded to saturated. A short shrub layer with low to moderate cover is often present. Leatherleaf is usually present at 80-100% cover but may be mixed with lesser amounts of other dwarf-shrubs. This association is also mapped as part of the BBX map unit when it occurs in inundated beaver complexes.

LSF-1A6 appears as an orange, relatively smooth signature bordering a watercourse. The leatherleaf forms a continuous and evenly dispersed low-growing mat, <0.5 meters in height. The photo was taken in September 1995.



LSF - Leatherleaf-Sweet Gale Shore Fen

LSF-2C6 occurs in a gradational pattern. The Sphagnum and leatherleaf mat grades into herbaceous vegetation nearer the waters' edge. The photo was taken in September 1996.



LSF-2B6 borders a watercourse. Although the orange is evident, the Sphagnum peat and leatherleaf are interspersed with herbaceous vegetation, indicated by the bluish color. The photo was taken in October 1996.

LSF-2B6 borders a watercourse. Although the orange is evident, the Sphagnum peat and leatherleaf are interspersed with herbaceous vegetation, indicated by the bluish color. The photo was taken in October 1996.

Area Report for LSF Map Unit
Polygons: 134
Hectares: 464
Acres: 1,146
Average size: 3 hectares, 9 acres

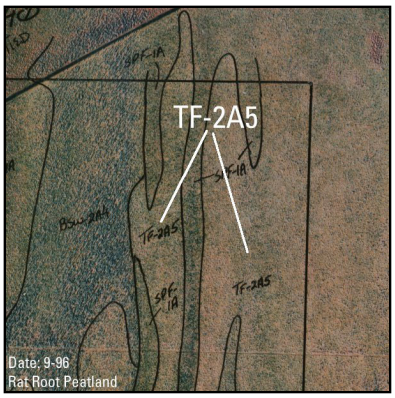
Accuracy Assessment Results for LSF Map Unit
The Leatherleaf-Sweet Gale Shore Fen Map Unit was assessed at 90% producers' accuracy (confidence interval 78-103%) and 90% users' accuracy (confidence interval 78-103%).

TF - Tamarack Scrub Poor Fen

Photo credit: Michael Lew-Smith

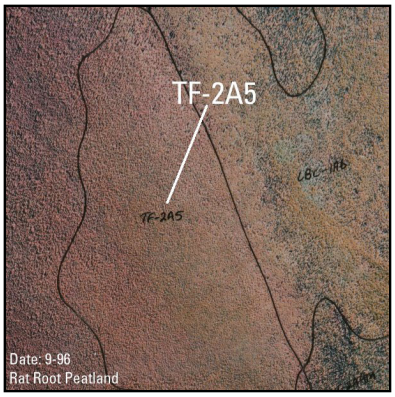
The Tamarack Scrub Poor Fen Map Unit (TF) represents the Tamarack Scrub Poor Fen Association. This association has been found only in the Rat Root River Peatland area west of the park. The height of the tamaracks does not generally exceed 2 meters. The Bog Birch - Leatherleaf Poor Fen Association may occur as small inclusions in this map unit. This association is very similar to the Northern Sedge Poor Fen Association, except for the percent cover of tamarack. In the Tamarack Scrub Poor Fen Association, the tamarack is >25% cover.

TF-2A5 appears as pale colors over olive-green and orange patches. The tamarack appears as a light-colored overcast. The olive-green patches are clumps of sedges, and the orange mat is Sphagnum and leatherleaf. The tamarack canopy is discontinuous and evenly dispersed. The height of the tamarack falls within the 0.5-5 meter range. This photo was taken in September 1996.



TF - Tamarack Scrub Poor Fen

TF-2A5 appears as pale pink, orange, and faint green. The texture is fine grained. The canopy is discontinuous and evenly dispersed. The photo was taken in September 1996.



Area Report for TF Map Unit
Polygons: 9
Hectares: 172
Acres: 425
Average size: 19 hectares, 47 acres

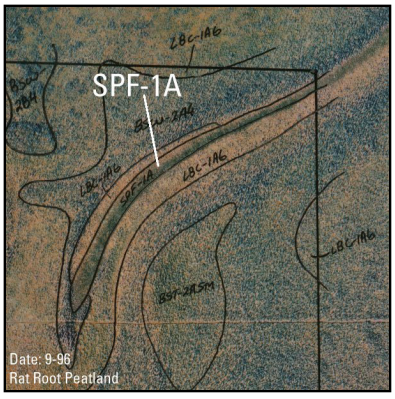
Accuracy Assessment Results for TF Map Unit
The Tamarack Scrub Poor Fen Map Unit was assessed at 100% producers' accuracy (confidence interval 95-105%) and 83% users' accuracy (61-105%).

SPF - Northern Sedge Poor Fen

Photo credit: Michael Lew-Smith

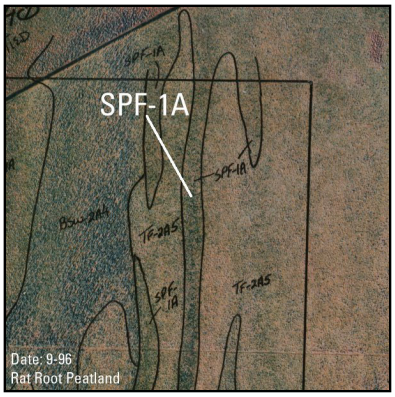
The Northern Sedge Poor Fen Map Unit (SPF) represents the Northern Sedge Poor Fen Association. This association occurs in and around water tracks of the Rat Root Peatland. The substrate is deep, fibric Sphagnum peat. 80 - 100% cover of *Carex lasiocarpa* dominates the Northern Sedge Poor Fen. Short, stunted tamarack trees, usually less than 2 meters tall, are present above the herbaceous layer. This association is very similar to the Tamarack Scrub Poor Fen Association (TF), except for the percent cover of tamarack. In the Northern Sedge Poor Fen Association, the tamarack is <25% cover.

SPF-1A appears as dark olive-green. The polygon follows a watercourse within a large peatland. The sedges form a continuous, evenly dispersed cover. The photo was taken in September 1996.



SPF - Northern Sedge Poor Fen

SPF-1A appears as dark olive-green. Similar to the example above, the polygon follows a watercourse in a large peatland. In this photo, SPF and TF grade into one another.



Area Report for SPF Map Unit
Polygons: 8
Hectares: 65
Acres: 161
Average Size: 8 hectares, 20 acres

Accuracy Assessment Results for SPF Map Unit
The Northern Sedge Poor Fen Map Unit was assessed at 100% producers' accuracy (confidence interval 94-106%) and 100% users' accuracy (94-106%).

BJ - Canada Bluejoint Eastern Meadow

Photo credit: Kevin Hop

The Canada bluejoint Eastern Meadow Map Unit (BJ) represents the Canada bluejoint Eastern Meadow Association. This association occurs predominately in old beaver meadows or along slow-moving streams. A continuous herbaceous cover of Canada bluejoint characterizes the association. This association is also mapped as the Wet Meadow/Fen Mosaic/Complex Map Unit (SMX) when it occurs in a mosaic pattern with other wet meadow herbaceous types, or when it cannot be confidently recognized on the aerial photographs from other wetland herbaceous types.

BJ-1A appears as light pink and shades of gray with a relatively smooth signature. This signature is characteristic for BJ. The coverage is continuous and evenly dispersed. This photo was taken in September 1995.

BJ - Canada Bluejoint Eastern Meadow

BJ-1A appears as pale blue and tan. A stream runs through the polygon. This photo was taken in October 1996 when the vegetation is no longer actively growing.

Area Report for BJ Map Unit
Polygons: 475
Hectares: 752
Acres: 1,858
Average size: 2 hectares, 4 acres

Accuracy Assessment Results for BJ Map Unit
The Canada Bluejoint Eastern Meadow was assessed at 96% producers' accuracy (confidence interval 86-105%) and 71% users' accuracy (confidence interval 56-86%). Producer's accuracy is considered adequate as mapped. Errors in users' accuracy were primarily associated with the Northern Sedge Wet Meadow, which is part of Map Unit SMX.

SMX - Wet Meadow/Fen Mosaic/Complex

Photo credit: Kevin Hop

The Wet Meadow/Fen Mosaic/Complex Map Unit (SMX) represents 5 herbaceous associations: Canada Bluejoint Eastern Meadow, Northern Sedge Wet Meadow, Wiregrass Sedge Shore Fen, Eastern Reed Marsh, and Midwest Cattail Deep Marsh. SMX occurs along shorelines of lakes, beaver impoundments, and low areas surrounded by upland.

This map unit was created to account for photo limitations and patterns of the vegetation on the ground. The photographs do not always show distinctive signatures between these associations, so mapping specific associations cannot be done confidently. Also, these associations often occur together in a mosaic pattern and fall below the minimum mapping unit of .5 ha., so they are not mapped as separate polygons.

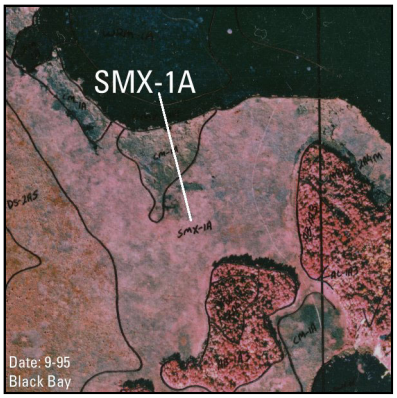
In any given polygon designated as SMX, one or more of these associations might occur. If only one association occurs, it is because the confidence level in interpreting the specific vegetation for that polygon was low.

Midwest Cattail Deep Marsh and Eastern Reed Marsh are mapped with SMX only when occurring in shallow water and either could not be distinguished from the other wet meadow herbaceous associations, or were seen as a mosaic pattern with the other wet meadow associations. In deeper water, they are mapped with other map units associated with deep water marsh types.

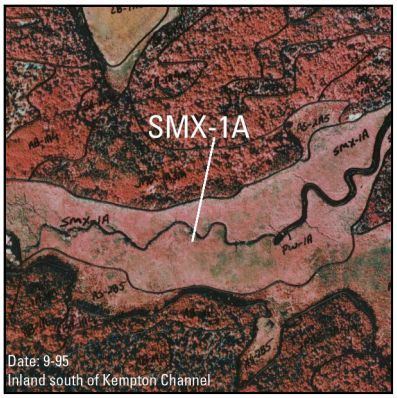
Polygons of SMX vary in appearance because it represents different combinations of these associations.

SMX - Wet Meadow/Fen Mosaic/Complex

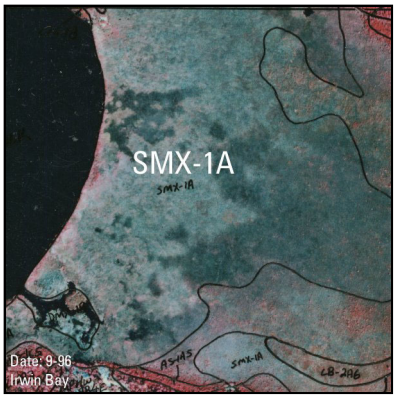
SMX-1A appears as a mottled pink and blue-gray signature next to a water body in this photo. The texture is relatively smooth. The color varies, reflecting the presence of different herbaceous species and variable water depths. The coverage is continuous and evenly dispersed. The photo was taken in September 1995.



SMX-1A appears as a mottled signature of pinks and greens, occurring either side of a stream. The signature, with its relatively smooth texture, varies in color, showing patches of the various associations that are part of SMX. The photo was taken in September 1995.

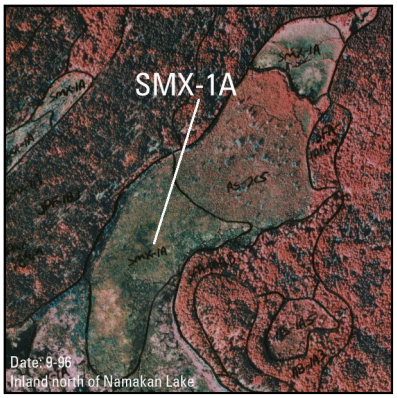


SMX-1A appears as blue-gray, indicating that much of the vegetation has lost its chlorophyll. The varying shades of gray are due to variable water depths, change in herbaceous species, or possibly depth of substrate deposition. The photo was taken in September 1996.



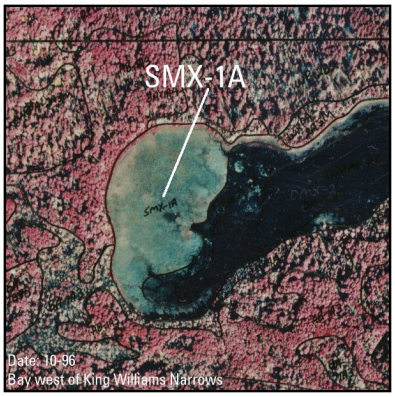
SMX - Wet Meadow/Fen Mosaic/Complex

SMX-1A appears as a mottling of dark greens, blues, grays, and browns. This polygon is located in the tail of a large beaver pond, falling between a Speckled Alder Swamp (AS) and a Deep Marsh Mosaic Complex (DMX). The photo was taken in September 1996.



SMX-1B appears as a mottled signature of pinks and greens. There are several small beaver ponds interspersed with the vegetation, resulting in a clumped coverage of SMX. The photo was taken in September 1996.

SMX-1A appears as a blue-green signature, indicating that much of the vegetation has lost its chlorophyll. The photo was taken in October 1996.



Area Report for SMX Map Unit
Polygons: 2,012
Hectares: 4,484
Acres: 11,080
Average size: 2 hectares, 6 acres

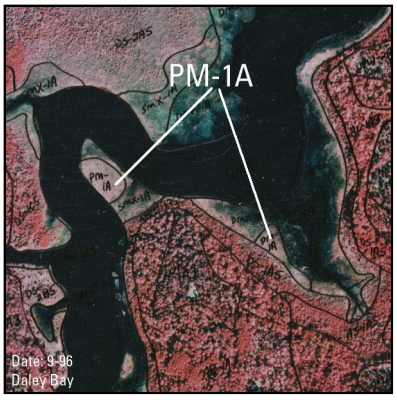
Accuracy Assessment Results for SMX Map Unit
The Wet Meadow/Fen Mosaic/Complex Map Unit was assessed at 67% producers' accuracy (confidence interval 55-80%) and 76% users' accuracy (confidence interval 64-89%). Errors in producer's accuracy were primarily associated with Map Unit BJ. Errors in users' accuracy were primarily associated with Map Unit WL.

PM - Eastern Reed Marsh

Photo credit: Michael Lew-Smith

The Eastern Reed Marsh Map Unit (PM) represents the Eastern Reed Marsh Association. This association occurs on shorelines of large lakes, most often on fairly wave-exposed sites on sandbars or shallow areas adjacent to islands. The Eastern Reed Marsh Association is composed primarily, and sometimes solely, by one species, common reed. The water regime is permanently flooded to intermittently exposed. Canada bluejoint and bulrushes may be present at low cover. A variety of submersed aquatic plants may also be found. This association is also mapped as part of the Wet Meadow/Fen Mosaic/Complex (SMX) when it occurs in relatively shallow water, and as part of the Deep Marsh Mosaic/Complex (DMX) when it occurs in relatively deep water. In these situations, Eastern Reed Marsh either occurs in a mosaic pattern with other wetland herbaceous types, or cannot be confidently recognized on the aerial photographs from the other wetland types.

PM-1A appears as a light pink signature in this photo. In stereoscopic view, this herbaceous signature appears billowy and tall. The coverage is continuous and evenly dispersed. This photo was taken in September 1996.



PM - Eastern Reed Marsh

Area Report for PM Map Unit
Polygons: 8
Hectares: 4
Acres: 9
Average size: <1 hectare, 1 acre

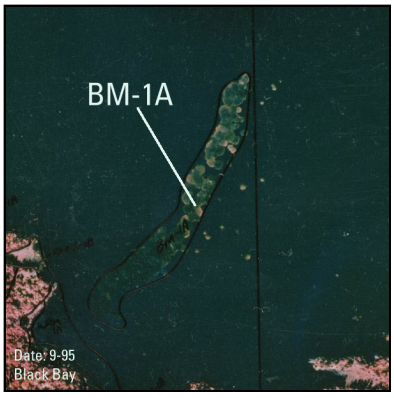
Accuracy Assessment Results for PM Map Unit
The Eastern Reed Marsh Map Unit was assessed at 67% producers' accuracy (confidence interval 27-107%) and 100% users accuracy (confidence interval 88-113%). Errors in producers' accuracy were primarily associated with Map Unit BJ. Users' accuracy is considered adequate as mapped.

BM - Freshwater Bulrush Marsh

Photo credit: Michael Lew-Smith

The Freshwater Bulrush Marsh Map Unit (BM) represents the Freshwater Bulrush Marsh Association. This association typically occurs on sheltered to moderately wave-exposed sites, primarily on the large lakes. Bulrushes dominate the association. A variety of submersed aquatic plants may also be found. The water regime is permanently flooded. This association is also mapped as part of the Deep Marsh Mosaic/Complex (DMX) when it occurs in a mosaic pattern with other deep marsh herbaceous types, or when it cannot be confidently recognized on the aerial photographs from the other deep marsh types.

BM-1A appears as a mottled yellow and dark olive-green signature. The coverage is continuous and evenly dispersed. The photo was taken in September 1995.



BM - Freshwater Bulrush Marsh

Area Report for BM Map Unit
Polygons: 6
Hectares: 7
Acres: 18
Average size: 1 hectare, 3 acre

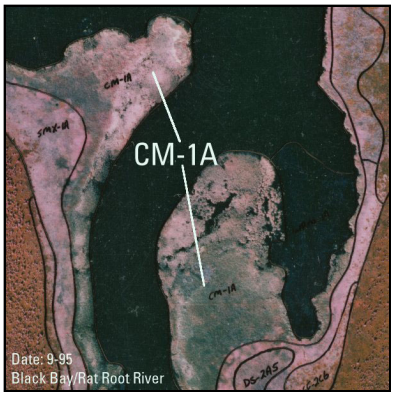
Accuracy Assessment Results for BM Map Unit
The Freshwater Bulrush Marsh Map Unit was assessed at 33% producers' accuracy (confidence interval -28-95%) and 33% users accuracy (confidence interval -28-95%). Errors in producers' accuracy were primarily associated with Map Unit WRM. Errors in users' accuracy were primarily associated with Map Unit PM.

CM - Midwest Cattail Deep Marsh

Photo credit: Kevin Hop

The Midwest Cattail Deep Marsh Map Unit (CM) represents the Midwest Cattail Deep Marsh Association. This association is found in shallow water (0.25 - 1 meter) along the shores of lakes. It can also occur in beaver floodings and low areas surrounded by uplands. This herbaceous association can be colonized almost exclusively by cattails, but other graminoids may be present. A variety of submersed aquatic plants may also be found. This association is also mapped as part of the Wet Meadow/Fen Mosaic/Complex (SMX) when it occurs in relatively shallow water, and as part of the Deep Marsh Mosaic/Complex (DMX) when it occurs in relatively deep water. In these situations, Midwest Cattail Deep Marsh either occurs in a mosaic pattern with other wetland herbaceous types, or cannot be confidently recognized on the aerial photographs from the other wetland types.

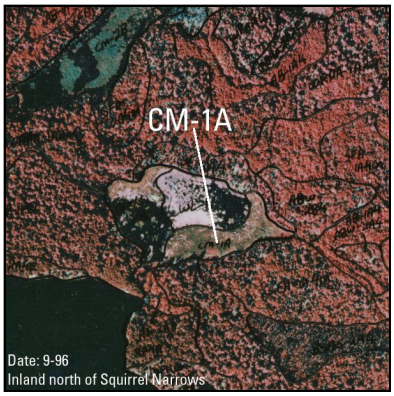
CM-1A ranges in color from gray-green to pale pink. The texture is relatively smooth and there are patches of dark water showing within the polygon where the cattails are less dense. The coverage is continuous and evenly dispersed. The polygons of cattail are situated adjacent to a bay. The photo was taken in September 1995.



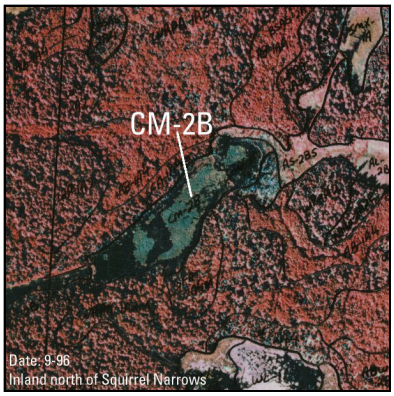
CM - Midwest Cattail Deep Marsh

CM-1A appears as greenish orange. The polygon of cattail borders a watercourse. The coverage is continuous and evenly dispersed. The photo was taken in September 1995.

CM-1A appears as patches of pink and pale green. The texture is smooth. The cattail stand is part of a beaver impoundment adjacent to open water and floating aquatic vegetation. The photo was taken in September 1996.

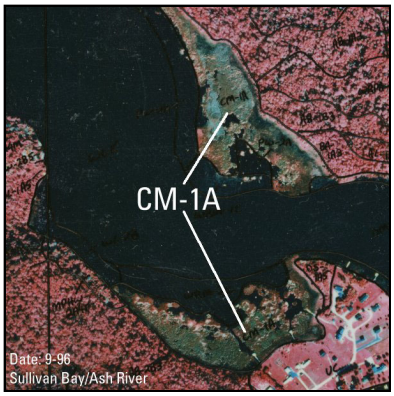


CM-2B appears blue-green, similar to the photo above. The cattail stand is part of a beaver impoundment. The cattail coverage is discontinuous and the clumped. The photo was taken in September 1996.

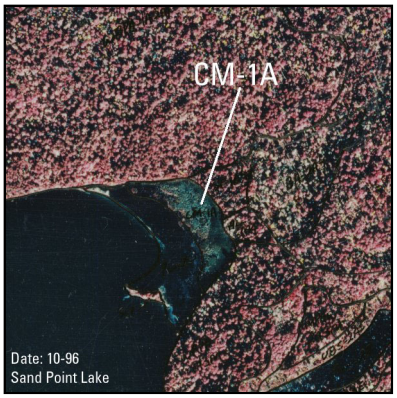


CM - Midwest Cattail Deep Marsh

CM-1A appears as a mottled blue-green in this photo. The edges of the cattail bed are somewhat ragged-looking as the bed reaches its water depth limit. The photo was taken in September 1996.



CM-1A appears as a patchy blue-green in the photo. The cattails have reached the end of the growing season and are no longer producing chlorophyll. The photo was taken in October 1996.



Area Report for CM Map Unit
Polygons: 212
Hectares: 475
Acres: 1,173
Average size: 2 hectare, 6 acres

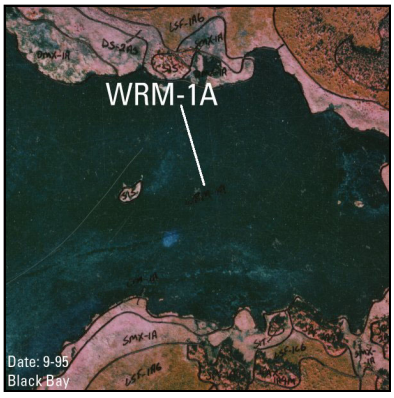
Accuracy Assessment Results for CM Map Unit
The Cattail Marsh Map Unit was assessed at 100% producers' accuracy (confidence interval 98-102%) and 95% users' accuracy (confidence interval 86-105%).

WRM - Wild Rice Marsh

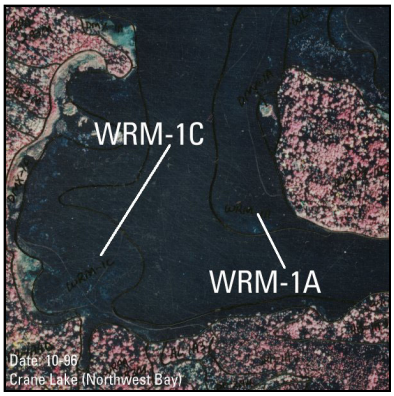
Photo credit: Kevin Hop

The Wild Rice Marsh Map Unit (WRM) represents the Wild Rice Marsh Association. This association is typically found in sheltered and isolated bays along the shores of the large lakes. These sites are permanently flooded with water 0.5 - 2 meters deep. Wild rice is the dominant species, but other emergent graminoids may be present at low cover. . A variety of submersed aquatic plants may also be found. This association is also mapped as part of the Deep Marsh Mosaic/Complex (DMX) when it occurs in a mosaic pattern with other deep marsh herbaceous types, or when it cannot be confidently recognized on the aerial photographs from the other deep marsh types.

WRM-1A is barely visible in this photo as pale blue splotches surrounded by dark water. Although it is difficult to see on this photo, the coverage is continuous and evenly distributed. The stereo photo reveals the wild rice bed more clearly. The photo was taken in September 1995.



WRM - Wild Rice Marsh



WRM-1C is barely discernable. The coverage is continuous and gradational, with higher densities nearer to shore. The patchy light blue areas are all that remains of the existing bed in October 1996, when this photo was taken.

As in the photo above, WRM-1C is barely discernable. The patchy light bluish areas are all that remain of the existing bed. This photo was taken in October 1996.

Area Report for WRM Map Unit
Polygons: 38
Hectares: 267
Acres: 661
Average size: 7 hectares, 17 acres

Accuracy Assessment Results for WRM Map Unit
The Wild Rice Marsh Map Unit was assessed at 88% producers' accuracy (confidence interval 72-104%) and 68% users' accuracy (confidence interval 50-87%). Errors in producers' accuracy were primarily associated with Map Unit PW. Users' accuracy is considered adequate as mapped.

DMX - Deep marsh Mosaic/Complex

Photo credit: Kevin Hop

Deep Marsh Mosaic/Complex Map Unit represents 7 herbaceous associations: Eastern Reed Marsh, Freshwater Bulrush Marsh, Midwest Cattail Deep Marsh, Wild Rice Marsh, Water Horsetail-Spikerush Marsh, Northern Water Lily Aquatic Wetland, and Midwest Pondweed Submerged Aquatic Wetland. DMX occurs in sheltered bays of lakes, along watercourses, and flooded beaver impoundments.

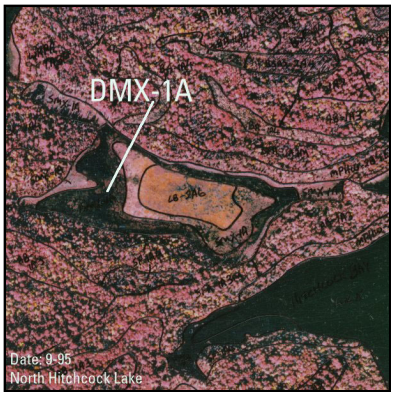
This map unit was created to account for photo limitations and patterns of the vegetation on the ground. The photographs do not always show distinctive signatures between these associations, so mapping specific associations cannot be done confidently. Also, these associations often occur together in a mosaic pattern and fall below the minimum mapping unit of .5 ha., so they are not mapped as separate polygons.

In any given polygon designated as DMX, one or more of these associations might occur. If only one association occurs, it is because the confidence level in interpreting the specific vegetation for that polygon was low.

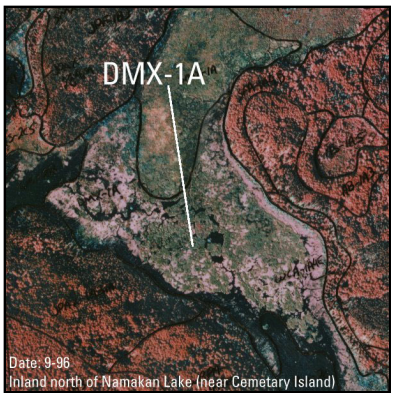
Midwest Cattail Deep Marsh and Eastern Reed Marsh are mapped with SMX when occurring in shallow water and either could not be distinguished from the other SMX herbaceous types, or were seen as a mosaic pattern with the other SMX herbaceous types.

DMX - Deep marsh Mosaic/Complex

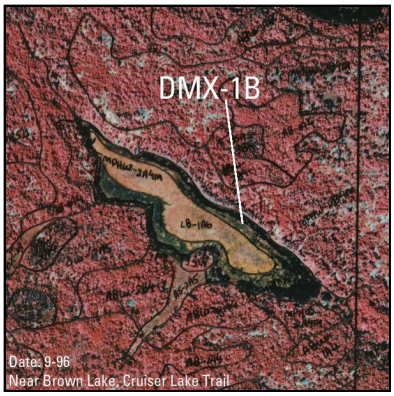
DMX-1A appears as a mix of dark colors. There is little contrast between the aquatic plants and the water making it difficult to see the continuous and evenly dispersed coverage pondweeds and cattails. The pondweeds and cattails occur in a mosaic of patches that are too small to map individually. This photo was taken in September 1995.



DMX-1A appears as mottled pink and green. The pink signature represents floating aquatic plants and the green signature represents cattails. Water borders the polygon on the one side. The photo was taken in September 1996.

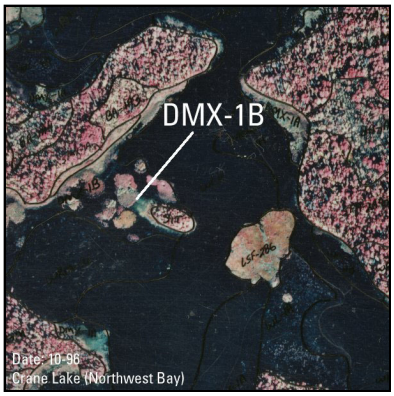


DMX-1B forms a rim around a leatherleaf bog. The cattails appear a mottled green surrounded by the darker signature of pondweeds. The pondweeds are difficult to see in the water. The coverage is continuous and clumped. The photo was taken in September 1996.



DMX - Deep Marsh Mosaic/Complex

DMX-1B appears as patches of pinks, blues, yellows, and darker colors. The photo was taken in October 1996.



Area Report for DMX Map Unit
Polygons: 959
Hectares: 1,852
Acres: 4,575
Average size: 2 hectares, 5 acres

Accuracy Assessment Results for DMX Map Unit
The Deep Marsh Mosaic/Complex Map Unit was assessed at 97% producers' accuracy (confidence interval 90-103%) and 100% users' accuracy (confidence interval 98-102%).

PW - Midwest Pondweed Submerged Aquatic Wetland

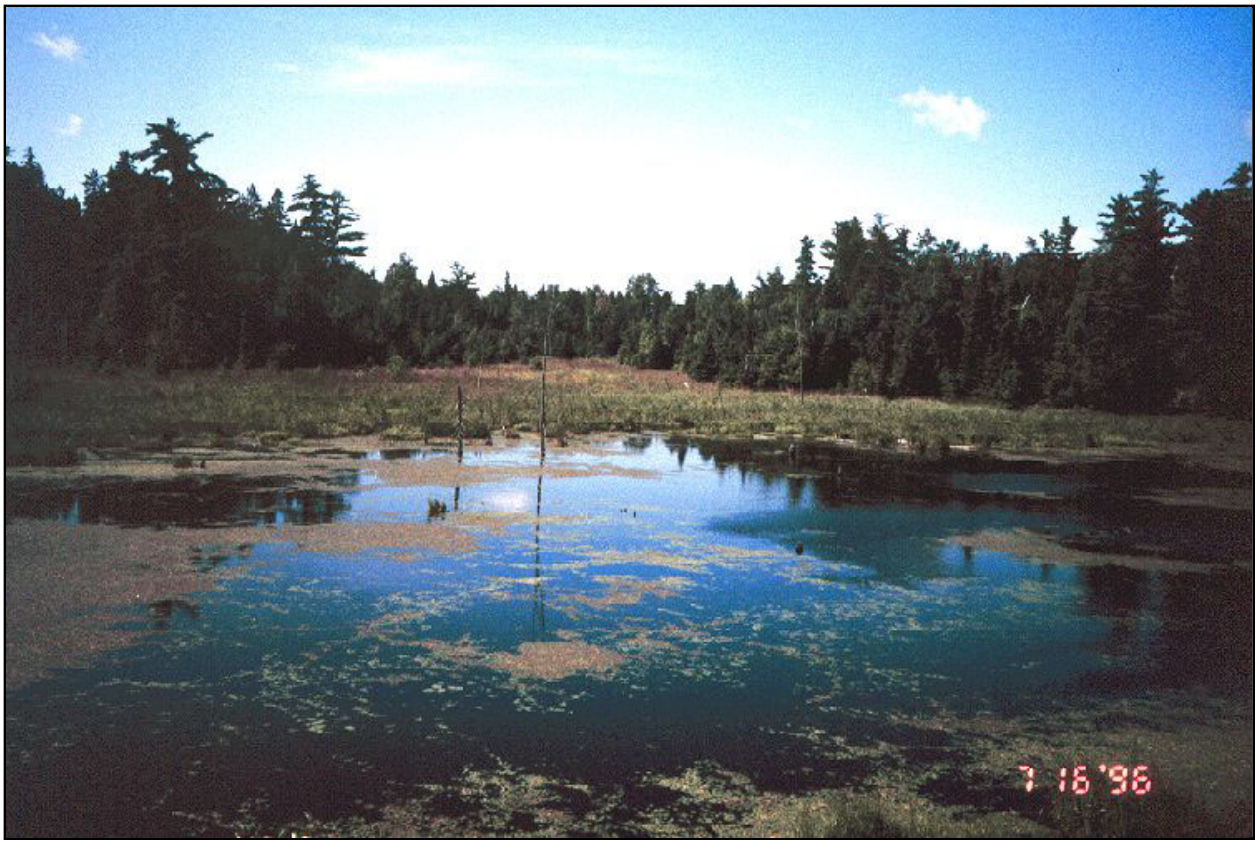
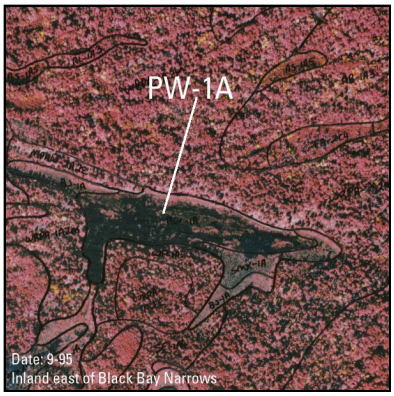


Photo credit: Kevin Hop

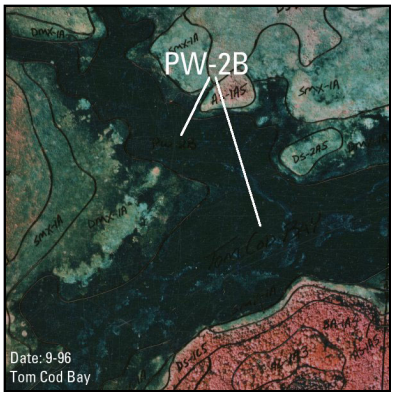
The Midwest Pondweed Submerged Aquatic Wetland Map Unit (PM) represents the Midwest Pondweed Submerged Aquatic Wetland Association. This association is found typically in fairly sheltered bays of the large lakes, in interior lakes, and in beaver ponds. It can also occur in more wave exposed sites on the large lakes. Water depth is typically 0.5 - 2 meters. The water regime is permanently flooded. This association is dominated by submergent aquatic plants, however, floating aquatic plants may be present in low cover. In stands that occur in beaver impoundments, standing dead trees and patches of emergent vegetation are common. This association is also mapped as part of the Deep Marsh Mosaic/Complex (DMX) when it occurs in a mosaic pattern with other deep marsh herbaceous types, or when it cannot be confidently recognized on the aerial photographs from the other deep marsh types. This association is also mapped as part of the BBX map unit when it occurs in inundated beaver complexes.

PW-1A appears as dark patches against the darker water. Although difficult to see on this photo, the coverage is continuous and evenly dispersed. There are small inclusions of herbaceous vegetation within the polygon (orange-pink patches). The photo was taken in September 1995.



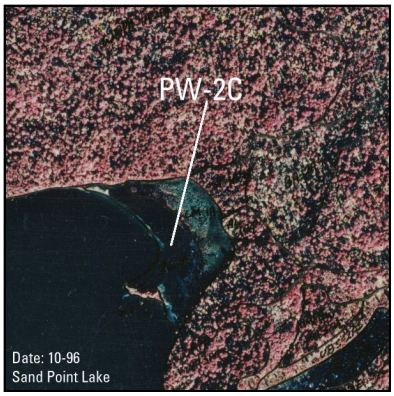
PW - Midwest Pondweed Submerged Aquatic Wetland

PW-2B is faintly discernible in this photo. The vegetation appears as pale blue splotches against the black water. The coverage is discontinuous and clumped. The photo was taken in September 1996.



PW-2A appears dark blue. The lighter blue is standing dead trees. The coverage is discontinuous and evenly dispersed. The photo was taken in October 1996.

PW-2C appears as dark blue. Although not clearly visible on this photo, the coverage pattern is gradational. (Cattails appear a lighter blue-green in the polygon adjacent to the pondweeds). The photo was taken in October 1996.



Area Report for PW Map Unit
Polygons: 669
Hectares: 1,223
Acres: 3,023
Average size: 2 hectares, 5 acres

Accuracy Assessment Results for PW Map Unit
The Midwest Pondweed Submerged Aquatic Wetland Map Unit was assessed at 71% producers' accuracy (confidence interval 49-92%) and 44% users' accuracy (confidence interval 27-62%). Errors in producers' accuracy were primarily associated with Map Unit WRM. Errors in users' accuracy were primarily associated with Map Unit WL.

WL - Northern Water Lily Aquatic Wetland

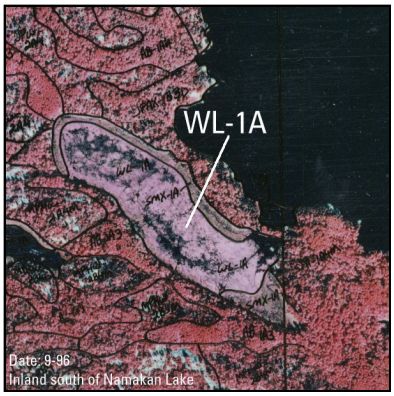
Photo credit: Michael Lew-Smith

The Northern Water Lily Aquatic Wetland Map Unit (WL) represents the Northern Water Lily Aquatic Wetland Association. This association is found typically in fairly sheltered bays of the large lakes, in interior lakes, and in beaver ponds. Water depth is 0.25 - 2 meters. The water regime is permanently flooded. In stands that occur in beaver impoundments, standing dead trees and patches of emergent vegetation are common. This association is dominated by floating aquatic plants and may have an extensive submergent aquatic plant layer. This association is also mapped as part of the Deep Marsh Mosaic/Complex (DMX) when it occurs in a mosaic pattern with other deep marsh herbaceous types, or when it cannot be confidently recognized on the aerial photographs from other deep marsh types. This association is also mapped as part of the BBX map unit when it occurs in inundated beaver complexes.

WL-1A appears as a pink signature on the surface of the darker water. The coverage is continuous and evenly dispersed. This photo was taken in September 1995.

WL - Northern Water Lily Aquatic Wetland

WL-1A appears as pale pink. The coverage is continuous and evenly dispersed. Small patches of darker water are visible throughout the polygon. The photo was taken in September 1996.



WL-1C appears nearly white. The water lily bed is denser on the left and lower sides of the polygon, and grades into water on the right side. The photo was taken in September 1996.

WL-1A appears as faint blue and pink splotches surrounded by water. Although difficult to see, the coverage is continuous and evenly dispersed. The photo was taken in October 1996, so the water lily has begun senescence.

Area Report for WL Map Unit
Polygons: 450
Hectares: 979
Acres: 2,418
Average size: 2 hectares, 5 acres

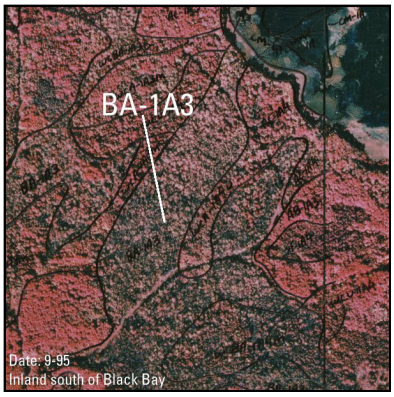
Accuracy Assessment Results for WL Map Unit
The Northern Water Lily Aquatic Wetland Map Unit was assessed at 46% producers' accuracy (confidence interval 31-61%) and 81% users' accuracy (confidence interval 64-97%). Errors in producers' accuracy were primarily associated with Map Unit PW. Users' accuracy is considered adequate as mapped.

BA - Black Ash-Mixed Hardwood Swamp

Photo credit: Michael Lew-Smith

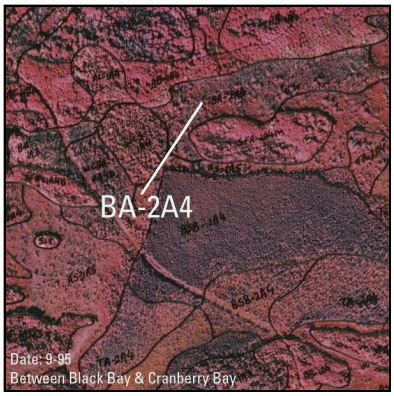
The Black Ash-Mixed Hardwood Swamp Map Unit (BA) represents the Black Ash - Mixed Hardwood Swamp Association. This association occurs in shallow depressions, low areas, and adjacent to peatlands. It is also mapped when occurring in drainage courses. The soils of this type consist of mineral soils or peat over dense clay. The water regime can be temporarily to seasonally flooded or saturated. The canopy most commonly consists solely of black ash. In some situations, cedar may be present at low cover.

BA-1A3 appears as pink and gray with a coarse texture in this photo. The pink represents leaf-on conditions of the black ash trees and the gray shows various stages of leaf-off. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter height class. The photo was taken in September 1995.

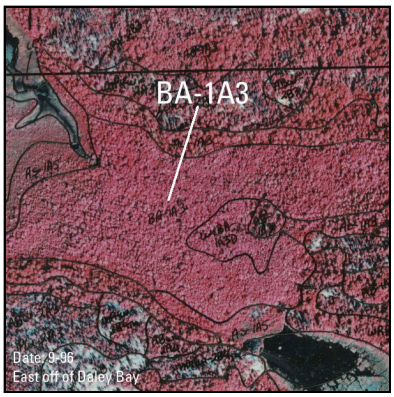


BA - Black Ash-Mixed Hardwood Swamp

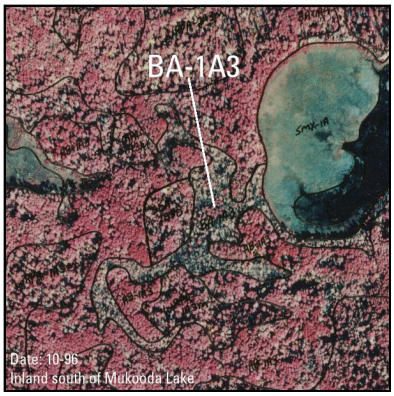
BA-2A4 appears gray and pink with patches of red-orange in this photo. The trees are gray and pink with a medium texture and the shrub understory is red-orange with smoother texture. The canopy of the trees is open and evenly dispersed. The trees fall in the 5-12 meter height range. The photo was taken in September 1995.



BA-1A3 appears as pink in this photo with coarse texture. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in September 1996 before leaf fall.



BA-1A3 appears as tan with different shades of gray and pink in this photo. The black ash trees have begun to lose chlorophyll and their leaves. The photo was taken in October 1996.



Area Report for BA Map Unit
Polygons: 1,586
Hectares: 2,677
Acres: 6,616
Average size: 2 hectares, 4 acres

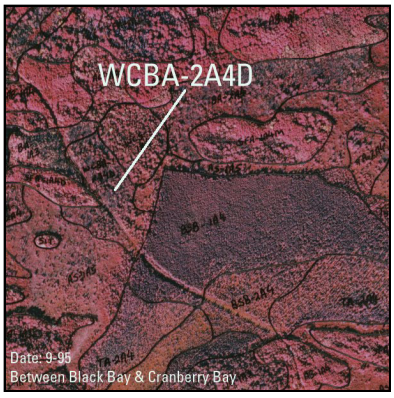
Accuracy Assessment Results for BA Map Unit
The Black Ash-Mixed Hardwood Swamp Map Unit was assessed at 71% producers' accuracy (confidence interval 56-86%) and 88% users' accuracy (confidence interval 75-101%). Errors in producers' accuracy were primarily associated with Map Unit WCBA. Users' accuracy is considered adequate as mapped.

WCBA - White Cedar-Black Ash Swamp

Photo credit: Michael Lew-Smith

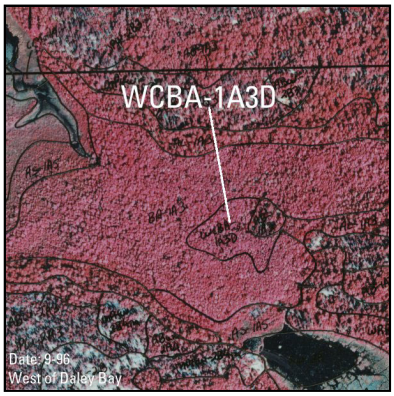
The White Cedar-Black Ash Swamp Map Unit (WCBA) represents the White Cedar - Black Ash Swamp Association. This association is found in confined basins surrounded by upland, as part of large wetland complexes, and is also mapped when occurring in drainage courses and low areas. Soils are either deep, well-decomposed peats, or shallow, well-decomposed peats over clay. The water regime is seasonally flooded to saturated. The dominant canopy species are black ash and white cedar, each comprising at least 25% cover. It is also found with a supra-canopy solely of black ash, with a sub-canopy of white cedar. In these cases, ancillary photographs from 1988 were used to determine the presence of the white cedar.

WCBA-2A4D appears as a mix of pink, gray, and dark red. The pink and the gray are the black ash in different stages of leaf-off, and the dark red is the white cedar. The canopy of the trees is discontinuous and evenly dispersed. The tree height falls within the 5-12 meter range. Black ash occurs at a higher percentage cover than the white cedar. The photo was taken in September 1995.

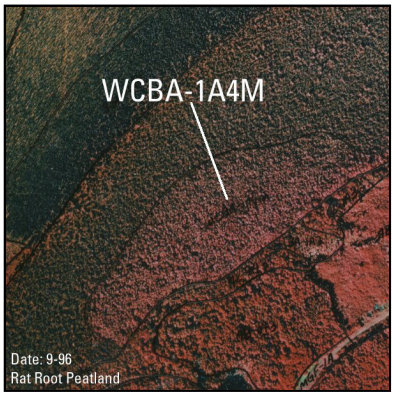


WCBA - White Cedar-Black Ash Swamp

WCBA-1A3D appears as pink in this photo. The canopy is closed and evenly dispersed. The white cedar is sub-canopy to the black ash and is obscured by the black ash crowns. Ancillary photographs from 1988 were used to determine the presence of the white cedar. The tree height falls within the 12-20 meter range, the height of the black ash. The black ash is dominant over the white cedar. The photo was taken in September 1996.



WCBA-1A4M appears as a mix of pink-red and dark red-brown. The tree height falls within the 5-12 meter range. The black ash and the white cedar are a relatively even mix. The photo was taken in September 1996.



Area Report for WCBA Map Unit
Polygons: 272
Hectares: 829
Acres: 2,049
Average size: 3 hectares, 8 acres

Accuracy Assessment Results for WCBA Map Unit
The White Cedar-Black Ash Swamp Map Unit was assessed at 81% producers' accuracy (confidence interval 67-86%) and 79% users' accuracy (confidence interval 64-93%). Producers' accuracy is considered adequate as mapped. Errors in users' accuracy were primarily associated with Map Unit BA.

BSAS - Black Spruce/Alder Rich Swamp

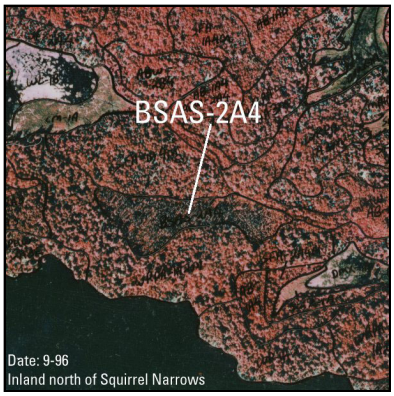
Photo credit: Kevin Hop

The Black Spruce/Alder Rich Swamp Map Unit (BSAS) represents the Black Spruce / Alder Rich Swamp Association. This association occurs as part of large peatlands, in confined basins, and along the upland margins of less minerotrophic peatlands. It is also mapped when occurring within slow moving drainage courses. Stands occur on level, wet, poorly drained organic soils on deep or shallow peat. The water regime is saturated. The canopy of black spruce is often fairly open, ranging from 20-40%. Tamarack and white cedar can also be found in the canopy at low cover. A shrub layer of alder and black spruce is normally present.

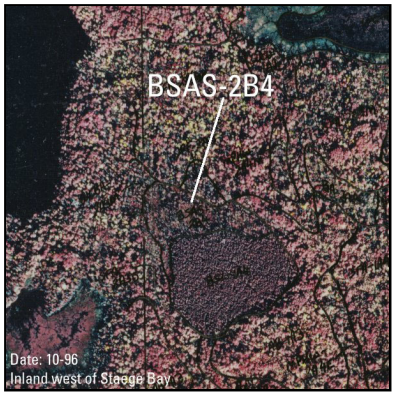
BSAS-2B4 appears as clumps of dark purple and orange in this photo. The dark purple is the black spruce trees and orange color is the alder shrubs. The canopy of the trees is continuous and clumped, revealing the uneven age and fairly open pattern typical of this association. The height of the trees falls within the 5-12 meter range. The photo was taken in September 1995.

BSAS - Black Spruce/Alder Rich Swamp

BSAS-2A4 appears mostly as dark purple with patches of orange in this photo. The dark purple is the black spruce trees and the orange is the alder shrub. The canopy of the trees is open and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.



BSAS-2B4 appears as dark blue and purple in this photo. Specks of lighter blues and purples indicate tamarack or dying trees. The canopy of the trees is relatively open and clumped. The tree height falls within the 5-12 meter range. The photo was taken in October 1996.



Area Report for BSAS Map Unit
Polygons: 536
Hectares: 707
Acres: 1,748
Average size: 1 hectares, 3 acres

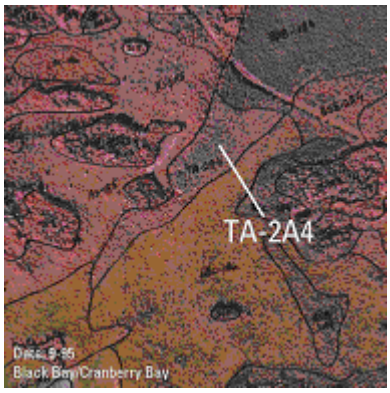
Accuracy Assessment Results for BSAS Map Unit
The Black Spruce/Alder Rich Swamp Map Unit was assessed at 76% producers' accuracy (confidence interval 59-94%) and 64% users' accuracy (confidence interval 46-82%). Errors in producers' accuracy were associated with Map Units BSL/BST. Errors in users' accuracy were associated with Map Units BSL/BST and WCS/WCT.

TA - Northern Tamarack Rich Swamp

Photo credit: Kevin Hop

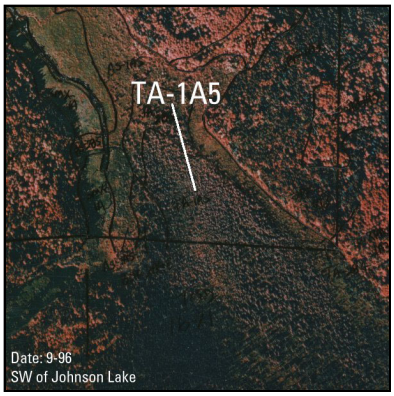
The Northern Tamarack Rich Swamp Map Unit (TA) represents the Northern Tamarack Rich Swamp Association. This association occurs as part of large peatlands, in confined basins, and along the upland margins of less minerotrophic peatlands. The substrate is deep, fibric Sphagnum peat or shallow peat over clay. The water regime is saturated. The canopy of tamarack is typically uneven-aged and fairly open. White cedar and black spruce may also occur in the canopy at low densities. A shrub layer of alder is typically present, but may also include bog birch and willows. In more peatland situations, the shrub layer is lower and Sphagnum mosses and ericaceous dwarf-shrubs tend to dominate the understory. Tamarack and black spruce sometimes appear similar on the 1995 and 1996 photographs. Ancillary photographs from 1988 were relied upon to distinguish signature differences between tamarack and black spruce.

TA-2A4 appears as pink and purple with a feathery texture in this photo. A slight orange cast gives evidence of the Sphagnum mosses and ericaceous dwarf shrubs in the understory. The canopy of the trees is open and evenly dispersed. The tree height falls within the 5-12 meter range.

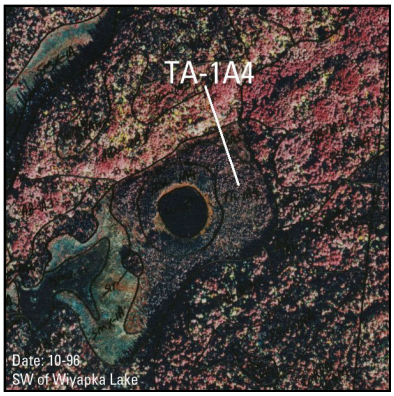


TA - Northern Tamarack Rich Swamp

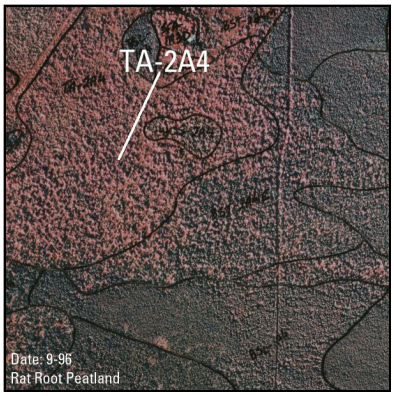
TA-1A5 appears as dark purple-gray and finely textured in this photo. The canopy is closed and evenly dispersed. The tree height falls within the 0.5-5 meter range. The photo was taken in September 1996.



TA-1A4 appears again as dark purple-gray and finely textured in this photo. The canopy is closed and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in October 1996.



TA-2A4 appears as pink and dark purple with an open, feathery texture in this photo. An alder understory is somewhat visible as blotches of orange. The canopy of the trees is open and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.



Area Report for TA Map Unit
Polygons: 255
Hectares: 705
Acres: 1,743
Average size: 3 hectares, 7 acres

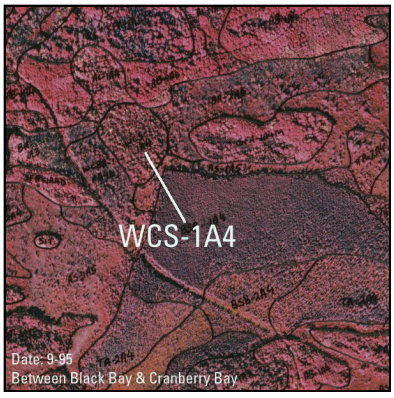
Accuracy Assessment Results for TA Map Unit
The Northern Tamarack Rich Swamp Map Unit was assessed at 98% producers' accuracy (confidence interval 94-102%) and 81% users' accuracy (confidence interval 72-90%).

WCS - White Cedar-(Mixed Conifer)/Alder Swamp (rich soil phase)

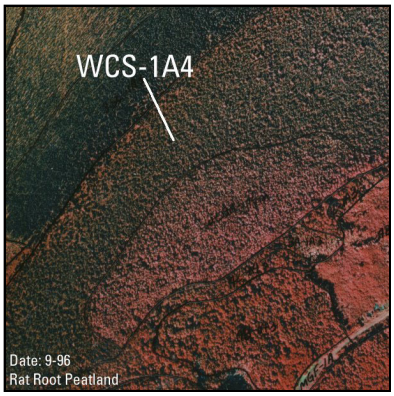
Photo credit: Kevin Hop

The White Cedar-(Mixed Conifer)/Alder Swamp (rich soil phase) Map Unit (WCS) represents, in part, the White Cedar - (Mixed Conifer) / Alder Swamp Association. WCS is the rich soil phase of this association and is dominated by white cedar with <25% tamarack in the canopy. WCS was originally thought to be the sole representation for this association. However, WCT was later joined, making two distinct map unit phases for the association (see description for WCT). This association occurs in localized areas, occurring on moderately minerotrophic conditions over deep peat. It is mapped when occurring along margins of large peatlands, and within slow moving drainage courses and confined basins. White cedar typically forms a fairly closed canopy. In larger peatlands, the canopy may be as low as 30%. A shrub layer of alder or balsam fir is nearly always present.

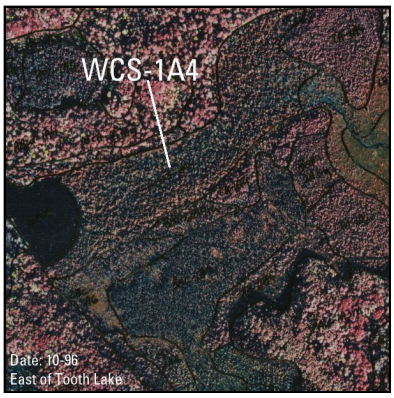
WCS-1A4 appears as red and dark red. The texture is somewhat rough. The canopy coverage is continuous and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1995.



WCS - White Cedar-(Mixed Conifer)/Alder Swamp (rich soil phase)



WCS-1A4 appears dark brown in this photo and is evenly and moderately fine-textured. The canopy is closed and evenly dispersed. The photo was taken in September 1996.



WCS-1A4 appears dark purple-blue in this photo and moderately fine-textured. The canopy is closed and evenly dispersed. The tree height falls within the 5-12 meter range.

Area Report for WCS Map Unit
Polygons: 214
Hectares: 1011
Acres: 2499
Average size: 5 hectares, 12 acres

Accuracy Assessment Results for WCS and WCT Map Units
The White Cedar-(Mixed Conifer)/Alder Swamp (rich soil phase) Map Unit was assessed with the White Cedar-(Mixed Conifer)/Alder Swamp (peatland phase) Map Unit. WCS and WCT were assessed at 68% producers' accuracy (confidence interval 55-82%) and 84% users' accuracy (confidence interval 71-96%). Errors in producers' accuracy were primarily associated with Map Units BSAS and BSL/BST. Users' accuracy is considered adequate as mapped.

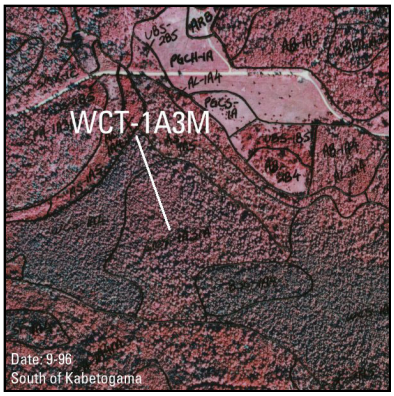
WCT - White Cedar-(Mixed Conifer)/Alder Swamp (peatland phase)

The White Cedar-(Mixed Conifer)/Alder Swamp (peatland phase) Map Unit (WCT) represents, in part, the White Cedar - (Mixed Conifer) / Alder Swamp Association. WCT is the peatland phase of this association that has 25-75% black spruce and tamarack in the canopy.

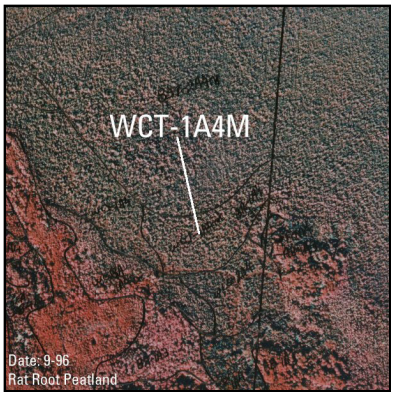
WCT was originally thought to represent the White Cedar - Tamarack Peat Swamp Association (an association not used for this project), but upon further analysis of the vegetation data, it was determined that WCT better represents the White Cedar - (Mixed Conifer) / Alder Swamp Association, sharing it with the WCS Map Unit (rich soil phase).

The dominance/co-dominance modifier was originally used for WCT mapping. Even though the association it now represents is classified as evergreen forest and not mixed evergreen-deciduous forest, the modifier was preserved to show the amounts of tamarack.

This association occurs on moderately minerotrophic conditions over deep peat. It is mapped when occurring along margins of large peatlands, and within slow moving drainage courses and confined basins. White cedar and tamarack typically form a fairly closed canopy. In larger peatlands, the canopy may be as low as 30%. A shrub layer of alder or balsam fir is nearly always present. Ancillary photographs from 1988 were used to help distinguish between white cedar and tamarack.



WCT-1A3M appears as pink, red, and dark blue-purple with a moderately fine texture. The pink is the tamarack, the dark blue-purple is the black spruce, and the red is the white cedar. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range. The white cedar and tamarack share equal dominance. The photo was taken in September 1996.



WCT-1A4M appears as dark gray and dark olive with specks of pink. The dark olive is white cedar with some black spruce, and the pink is the tamarack. The canopy cover is continuous and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.

Area Report for WCT Map Unit
Polygons: 24
Hectares: 64
Acres: 158
Average size: 3 hectares, 7 acres

Accuracy Assessment Results for WCT and WCS Map Unit
The White Cedar-(Mixed Conifer)/Alder Swamp (peatland phase) Map Unit was assessed with the White Cedar-(Mixed Conifer)/Alder Swamp (rich soil phase) Map Unit. WCT and WCS were assessed at 68% producers' accuracy (confidence interval 55-82%) and 84% users' accuracy (confidence interval 71-96%). Errors in producers' accuracy were primarily associated with Map Units BSAS and BSL/BST. Users' accuracy is considered adequate as mapped.

BSL - Black Spruce/Labrador Tea Poor Swamp (evergreen phase)

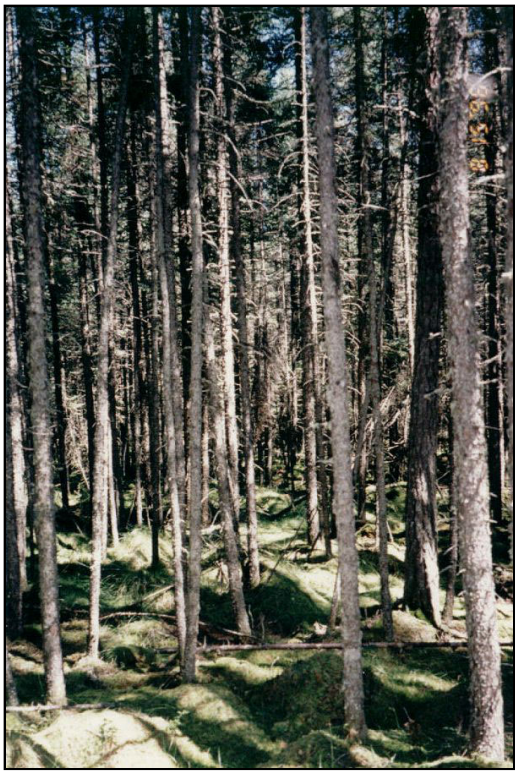


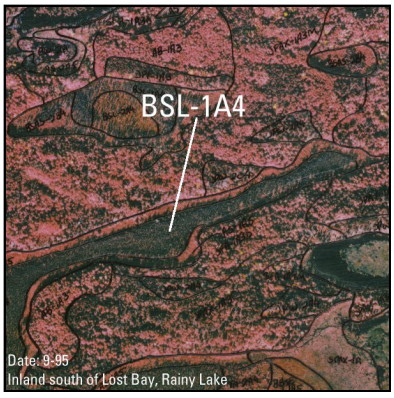
Photo credit: Kevin Hop

Photo credit: Kevin Hop

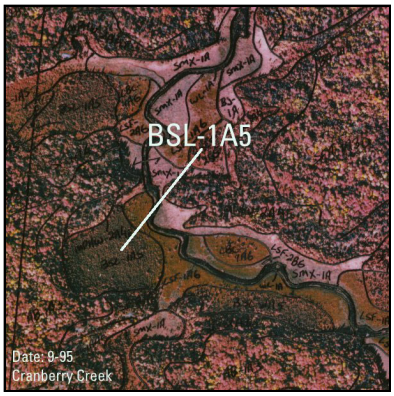
The Black Spruce/Labrador Tea Poor Swamp (evergreen phase) Map Unit (BSL) represents, in part, the Black Spruce / Labrador Tea Poor Swamp Association. BSL is the evergreen phase of this association and is dominated by black spruce with <25% tamarack in the canopy. BSL was originally thought to be the sole representation for this association. However, the BST Map Unit (mixed phase) was later joined, making two distinct map unit phases for the association (see description for BST).

This association is found in confined basins, on the upland margins of large peatlands, in poorly drained depressions in bedrock, and removed from the water's edge on peatland shorelines. It is also mapped within slow moving drainage courses. The substrate is deep, acidic Sphagnum peat. The water regime is saturated.

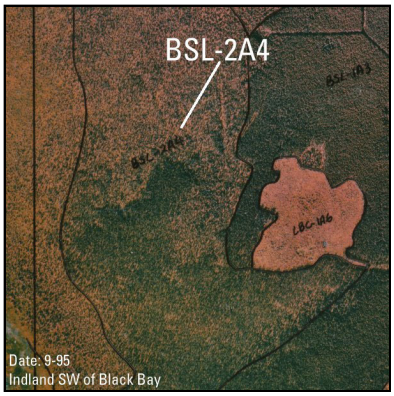
BSL-1A4 appears as a dark blue-magenta with a fine texture. This photo shows the black spruce within drainage course. The orange and smooth texture surrounding the black spruce is alder shrubs and is separated from the BSL polygon. The canopy is closed and is evenly dispersed. The tree height falls within the 5-12 meter range.



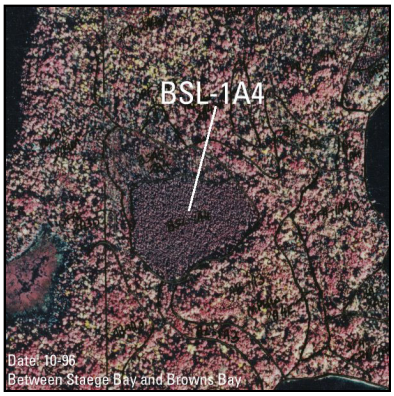
BSL - Black Spruce/Labrador Tea Poor Swamp (evergreen phase)



BSL-1A5 appears as deep rust with a fine texture. The canopy is closed and evenly dispersed. The tree height falls within the 0.5-5 meter range. The photo was taken in September 1995.



BSL-2A4 appears as a mottled dark olive-green and orange. The dark olive-green is the black spruce and the orange is ericaceous dwarf-shrubs. Although clumps of closed canopy are present, the general canopy of the trees throughout the polygon is open and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1995.



BSL-1A4 appears as blue-magenta and moderately fine textured. The bluish appearance and slightly feathered texture may be due to the presence of scattered tamarack. The canopy is closed and evenly dispersed. The photo was taken in October 1996.

Area Report for BSL Map Unit
Polygons: 704
Hectares: 2,937
Acres: 7,257
Average size: 4 hectares, 10 acres

Accuracy Assessment Results for BSL and BST Map Units
The Black Spruce/Labrador Tea Poor Swamp (evergreen phase) Map Unit was assessed with the Black Spruce/Labrador Tea Poor Swamp (mixed phase) Map Unit. BSL and BST were assessed at 77% producers' accuracy (confidence interval 69-85%) and 89% users' accuracy (confidence interval 82-96%). Errors in producers' accuracy were primarily associated with Map Units BSAS and TA. Users' accuracy is considered adequate as mapped.

BST - Black Spruce/Labrador Tea Poor Swamp (mixed phase)

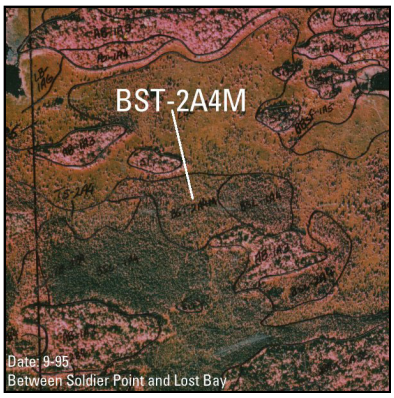
The Black Spruce/Labrador Tea Poor Swamp (mixed phase) Map Unit (BST) represents, in part, the Black Spruce / Labrador Tea Poor Swamp Association. BST is the mixed phase of this association that has 25-75% black spruce and tamarack in the canopy.

BST was originally thought to represent the Black Spruce - Tamarack Poor Swamp Association (an association not used for this project), but upon further analysis of the vegetation data, it was determined that BST better represents the Black Spruce / Labrador Tea Poor Swamp Association, sharing it with the BSL Map Unit (evergreen phase).

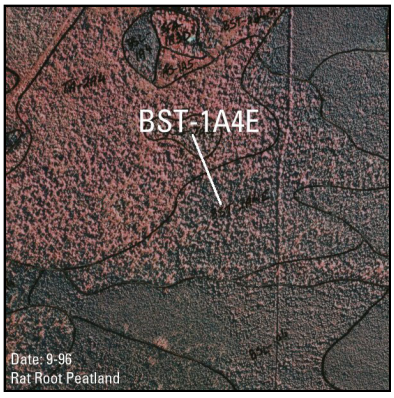
The dominance/co-dominance modifier was originally used for BST mapping. Even though the association it now represents is classified as evergreen forest and not mixed evergreen-deciduous forest, the modifier was preserved to show the amounts of tamarack.

This association is found in confined basins, on the upland margins of large peatlands, in poorly drained depressions in bedrock, and removed from the water's edge on peatland shorelines. It is also mapped within slow moving drainage courses. The substrate is deep, acidic Sphagnum peat. The water regime is saturated. Ancillary photographs from 1988 were used to help distinguish signature differences between tamarack and black spruce.

BST-2A4M appears as a mottled dark gray-green and orange with both fine and feathered textures in this photo. The dark gray-green is the conifer trees, and the orange is alder shrubs and ericaceous dwarf-shrubs. The canopy of the trees is open and evenly dispersed. The tree height falls within the 5-12 meter range. The black spruce and tamarack share dominance. The photo was taken in September 1995.

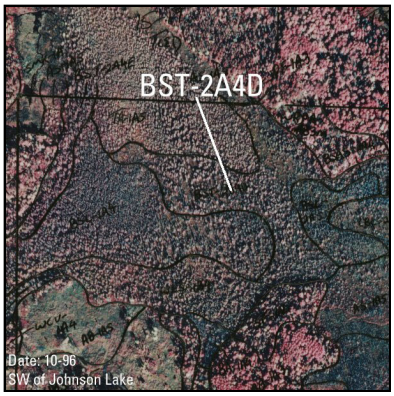


BST-1A4E appears as blue-magenta with pink dots, and a fine and somewhat rough texture. The canopy is closed and evenly dispersed. The tree height falls within the 5-12 meter range. The black spruce dominates over the tamarack in this polygon. The photo was taken in September 1996.

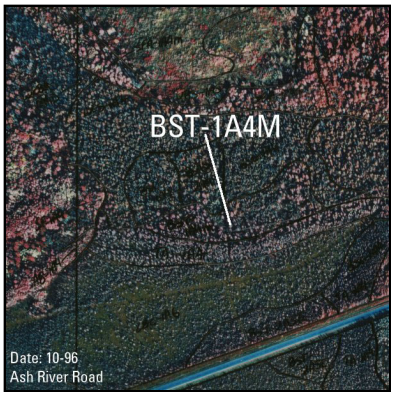


BST - Black Spruce/Labrador Tea Poor Swamp (mixed phase)

BST-2A4D appears as light toned speckles over dark purple and dark gray. The texture is somewhat feathery to moderately rough. The lighter tones are the tamarack, and the dark purple is black spruce. The dark gray is due to shadows. The canopy is open and evenly dispersed. The tree height falls within the 5-12 meter range. The tamarack dominates over the black spruce in this polygon. The photo was taken in October 1996. Ancillary 1988 photos give clearer indication of the tamarack.



BST-1A4M appears as dark blue-magenta, pink, and pale blue and a mix of fine and somewhat rough textures. The dark blue-magenta is the black spruce, and the pink and pale blue are the tamarack. The canopy is open and evenly dispersed. The tree height falls within the 5-12 meter range. The black spruce and tamarack share equal dominance in this polygon.



Area Report for BST Map Unit
Polygons: 224
Hectares: 938
Acres: 2,318
Average size: 4 hectares, 10 acres

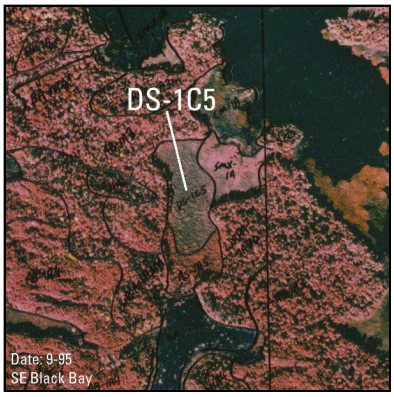
Accuracy Assessment Results for BST and BSL Map Units
The Black Spruce/Labrador Tea Poor Swamp (mixed phase) Map Unit was assessed with the Black Spruce/Labrador Tea Poor Swamp (evergreen phase) Map Unit. BST and BSL were assessed at 77% producers' accuracy (confidence interval 69-85%) and 89% users' accuracy (confidence interval 82-96%). Errors in producers' accuracy were primarily associated with Map Units BSAS and TA. Users' accuracy is considered adequate as mapped.

DS - Dogwood Pussy Willow Swamp

Photo credit: Kevin Hop

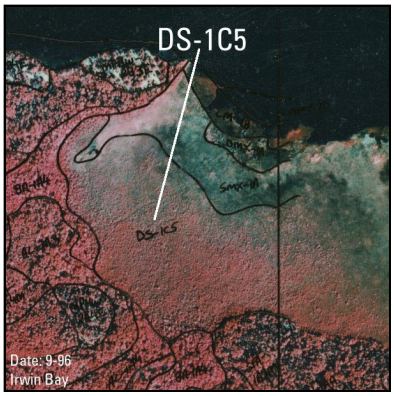
The Dogwood-Pussy Willow Swamp Map Unit (DS) represents the Dogwood - Pussy Willow Swamp Association. This association commonly occupies beaver meadows and the shorelines of the large lakes. It is also mapped when occurring along watercourses. Soils are either deep peats or shallow peats over clay. The water regime is temporarily to seasonally flooded or saturated. Willow species dominate stands of this association. Alder shrubs may also be present.

DS-1C5 appears as gray-green with an evenly pitted texture. The shrub cover is continuous and gradational. The height of the shrubs falls within the 0.5-5 meter range. The photo was taken in September 1995.

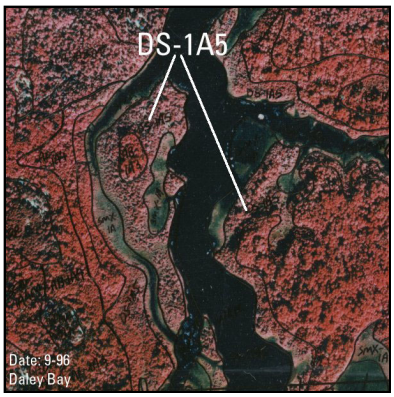


DS - Dogwood Pussy Willow Swamp

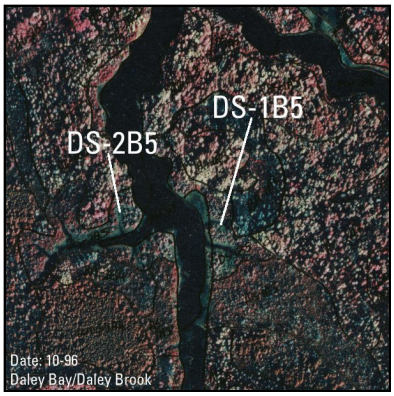
DS-1C5 appears as red-orange and blue-green with an evenly pitted texture. The red-orange is willow and the blue-green is cattail. The shrub cover is continuous and changes gradually from a dense stand to a thin stand as it approaches the lake shoreline. The height of the shrubs falls within the 0.5-5 meter range. The photo was taken in September 1996.



DS-1A5 appears as dark pink with a popcorn ball texture. The shrub cover is continuous and the pattern is evenly dispersed. The height of the shrubs falls within the upper range of 0.5-5 meter category. The photo was taken in September 1996.



DS-1B5 and DS-2B5 appear dark blue with tan speckles and a lumpy texture. The tan speckles are the willow and the dark blue is herbaceous vegetation. The shrub cover for DS-1B5 is continuous and clumped. The shrub cover for DS-2B5 is discontinuous and clumped. The shrub height falls within the 0.5-5 meter range. The photo was taken in October 1996.



Area Report for DS Map Unit
Polygons: 262
Hectares: 587
Acres: 1,450
Average size: 2 hectares, 6 acres

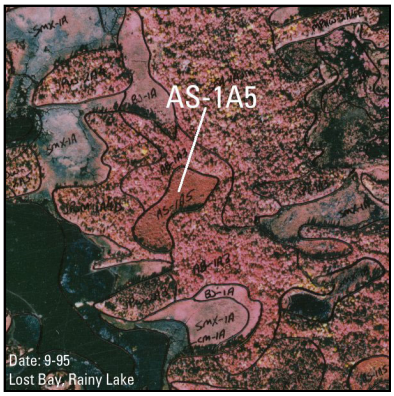
Accuracy Assessment Results for DS Map Unit
The Dogwood-Pussy Willow Map Unit was assessed at 85% producers' accuracy (confidence interval 72-98%) and 82% users' accuracy (confidence interval 68-96%).

AS - Speckled Alder Swamp

Photo credit: Kevin Hop

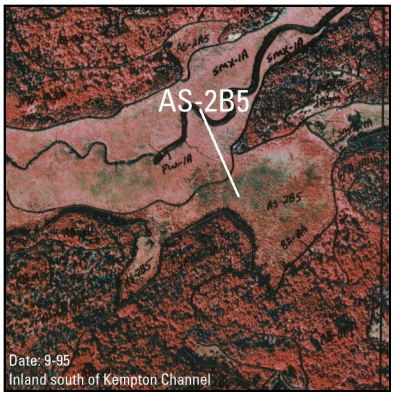
The Speckled Alder Swamp Map Unit (AS) represents the Speckled Alder Swamp Association. This association occurs in isolated low areas surrounded by upland, around the edges of less minerotrophic peatlands. It is also mapped along watercourses and lake shorelines. Stands can occur on deep peats, shallow peats, or mineral soils where drainage is impeded by clay. The water regime can be temporarily or seasonally flooded, or remain saturated throughout the growing season. Alder shrubs usually form a dense canopy in this association. Willow and bog birch shrubs may also be present.

AS-1A5 appears as red-orange with a smooth and slightly pitted texture. The shrub cover is continuous and evenly dispersed. The height of the shrubs falls within the 0.5-5 meter range. The photo was taken in September 1995.

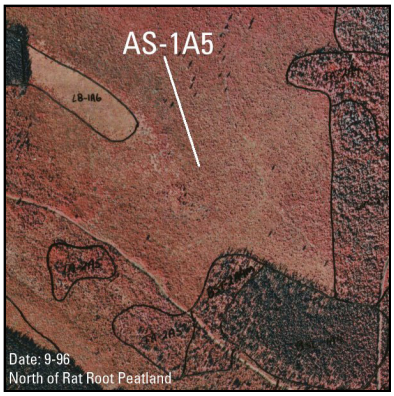


AS - Speckled Alder Swamp

AS-2B5 appears as red-orange, green, and pink with smooth and rough textures. The red-orange is alder, and the green and pink is herbaceous vegetation. The shrub cover is discontinuous and clumped. The height of the shrubs falls within the 0.5-5 meter range. The photo was taken in September 1995.



AS-1A5 appears orange and tan with a finely grained texture. The orange is alder and the tan is herbaceous vegetation. The shrub cover is continuous and evenly dispersed. The height of the shrubs falls within the 0.5-5 meter range. This polygon reveals a clear-cut area that was formerly a conifer swamp. The photo was taken in September 1995.



AS-2A5 appears as blue, light red, and orange with a grainy texture. The light red and orange is alder and the blue is standing dead conifer trees. The coverage is discontinuous and the pattern is evenly dispersed. The photo was taken in September 1996.

Area Report for AS Map Unit
Polygons: 1,595
Hectares: 2,825
Acres: 6,981
Average size: 2 hectares, 4 acres

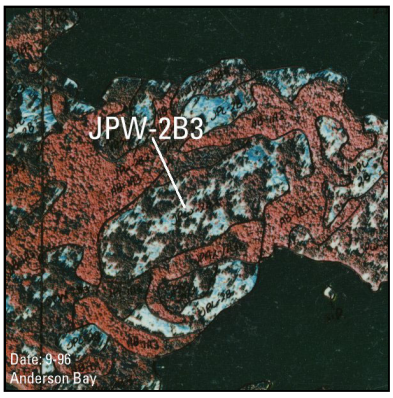
Accuracy Assessment Results for AS Map Unit
The Speckled Alder Map Unit was assessed at 79% producers' accuracy (confidence interval 67-92%) and 87% users' accuracy (confidence interval 76-99%).

JPW - Boreal Pine Rocky Woodland (jack pine phase)

Photo credit: Kevin Hop

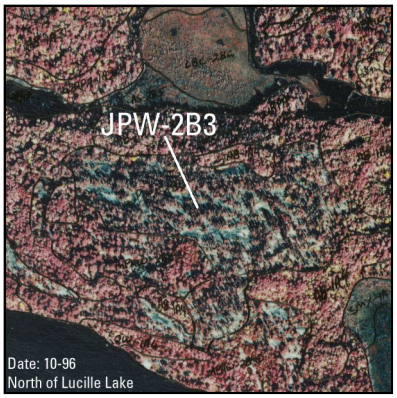
The Boreal Pine Rocky Woodland (jack pine phase) Map Unit (JPW) represents, in part, the Boreal Pine Rocky Woodland Association. JPW is dominated by jack pine. JPW was originally thought to be the sole representation for this association. However, the JPM Map Unit (mixed pine phase) was later joined, making two distinct map unit phases for the association (see discussion for JPM). This association occurs on ridge tops and slopes with 5-50% exposed bedrock. Slopes are highly variable and range from flat to very steep with variable aspects. Vegetation occurs where soil has collected over bedrock. These sites are rapidly drained. The tree canopy is variable and typically open. Black spruce may also be present.

JPW-2B3 appears as dark red-brown with a moderately smooth texture and as pale blue with a slate-like texture. The dark red-brown is the jack pine. The shadows obscure the shapes of the jack pine trees. The pale blue is exposed bedrock with lichens. The canopy is open and clumped. The photo was taken in September 1996.

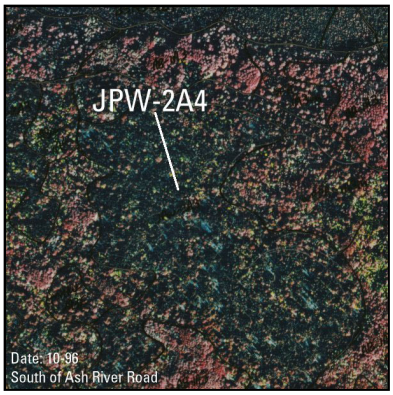


JPW - Boreal Pine Rocky Woodland (jack pine phase)

JPW-2B3 appears dark red-brown, pink, and pale blue. The texture is similar to the previous photo. The dark red-brown is the jack pine, and the pink is small clumps of aspen or birch scattered throughout the polygon. The photo was taken in October 1996.



JPW-2A4 appears charcoal with yellow dots and pale blue patches. The charcoal is the jack pine, the yellow are deciduous trees, and the pale blue is exposed bedrock. The canopy is open and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in October 1996.



Area Report for JPW Map Unit
Polygons: 1,087
Hectares: 2,118
Acres: 5,233
Average size: 2 hectares, 5 acres

Accuracy Assessment Results for JPW and JPM Map Units
The Boreal Pine Rocky Woodland (jack pine phase) Map Unit was assessed with Boreal Pine Rocky Woodland (mixed pine phase) Map Unit. JPW and JPM were assessed at 72% producers' accuracy (confidence interval 61-83%) and 100% users' accuracy (confidence interval 99-101%). Errors in producers' accuracy were primarily associated with Map Unit MPHW. Users' accuracy is considered adequate as mapped.

JPM - Boreal Pine Rocky Woodland (mixed pine phase)

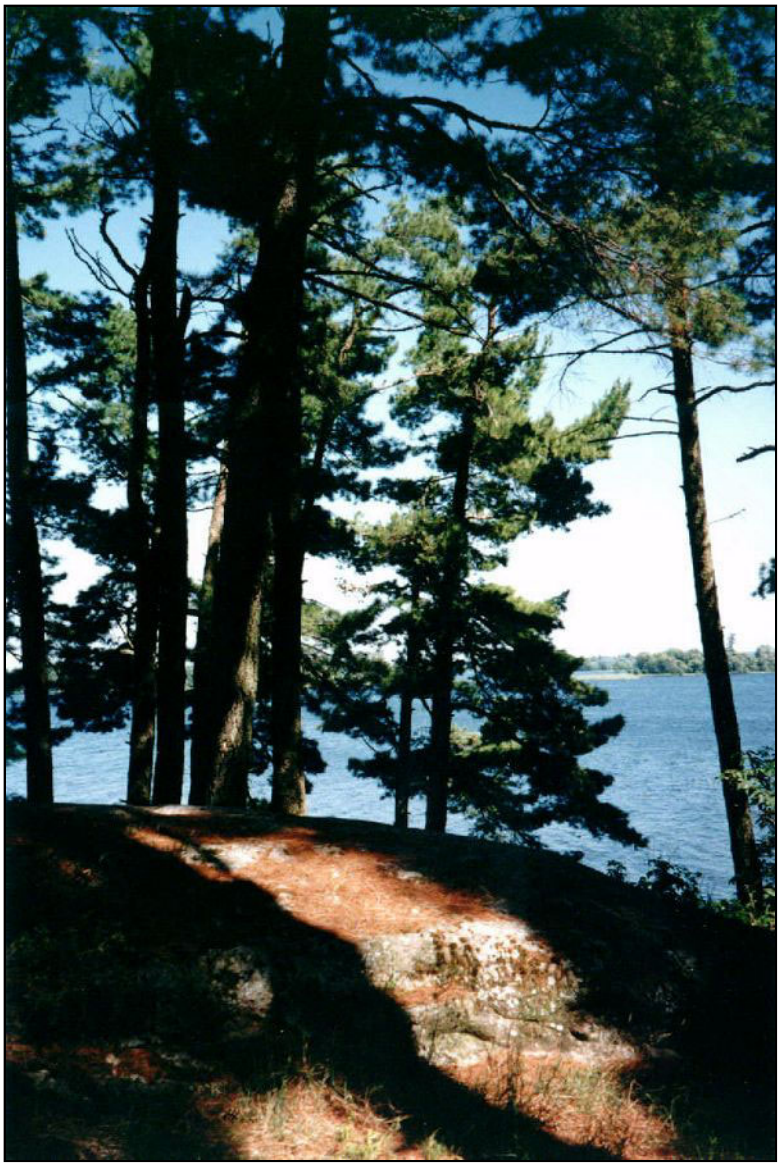
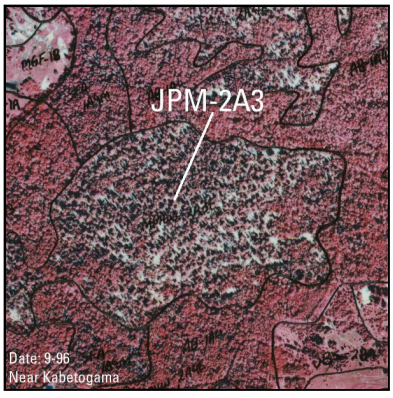


Photo credit: Kevin Hop

The Boreal Pine Rocky Woodland (mixed pine phase) Map Unit (JPM) represents, in part, the Boreal Pine Rocky Woodland Association. JPM is dominated by a combination of jack pine, red pine, and white pine. JPM was originally thought to represent an undefined and broadly characterized woodland type. Upon further analysis of the vegetation data, it was determined that the evergreen dominant portion of this undefined woodland type better represents the Boreal Pine Rocky Woodland Association, sharing it with the JPW Map Unit (jack pine phase).

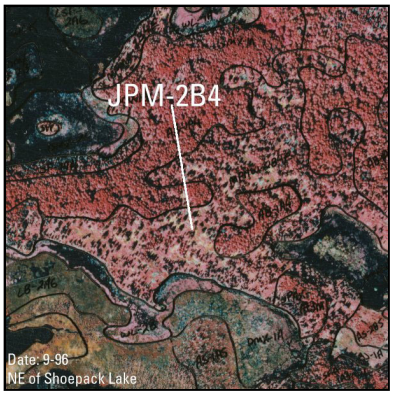
This association occurs on ridge tops and slopes with 5-50% exposed bedrock. Slopes are highly variable and range from flat to very steep with variable aspects. Vegetation usually occurs where soil has collected over bedrock. These sites are rapidly drained. The tree canopy is variable and typically open. Black spruce may also be present.

JPM-2A3 appears as a mixture of reds with a rough texture and splotches of white with a smooth texture. The reds are the pines and white is exposed bedrock with lichens. The canopy is open and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in September 1996.



JPM - Boreal Pine Rocky Woodland (mixed pine phase)

JPM-2B4 appears a mixture of reds with a rough texture, and pinks, pale orange, and white with a somewhat smooth texture. The reds are the pines, the pinks are herbaceous vegetation, and the pale orange are dwarf-shrubs. The white is exposed bedrock with lichens. The canopy is open and clumped. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.



JPM-2A3 appears as a dark crimson with a rough texture and a few splotches of pale blue with a smooth texture. The dark crimson are pines, and the pale blue is exposed bedrock with lichens. The canopy is open and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in October 1996.

Area Report for JPM Map Unit
Polygons: 1,774
Hectares: 3,351
Acres: 8,280
Average size: 2 hectares, 5 acres

Accuracy Assessment Results for JPM and JPW Map Unit
The Boreal Pine Rocky Woodland (mixed pine phase) Map Unit was assessed with Boreal Pine Rocky Woodland (jack pine phase) Map Unit. JPM and JPW were assessed at 72% producers' accuracy (confidence interval 61-83%) and 100% users' accuracy (confidence interval 99-101%). Errors in producers' accuracy were primarily associated with Map Unit MPHW. Users' accuracy is considered adequate as mapped.

JPL - Jack Pine/Lichen Rocky Barrens

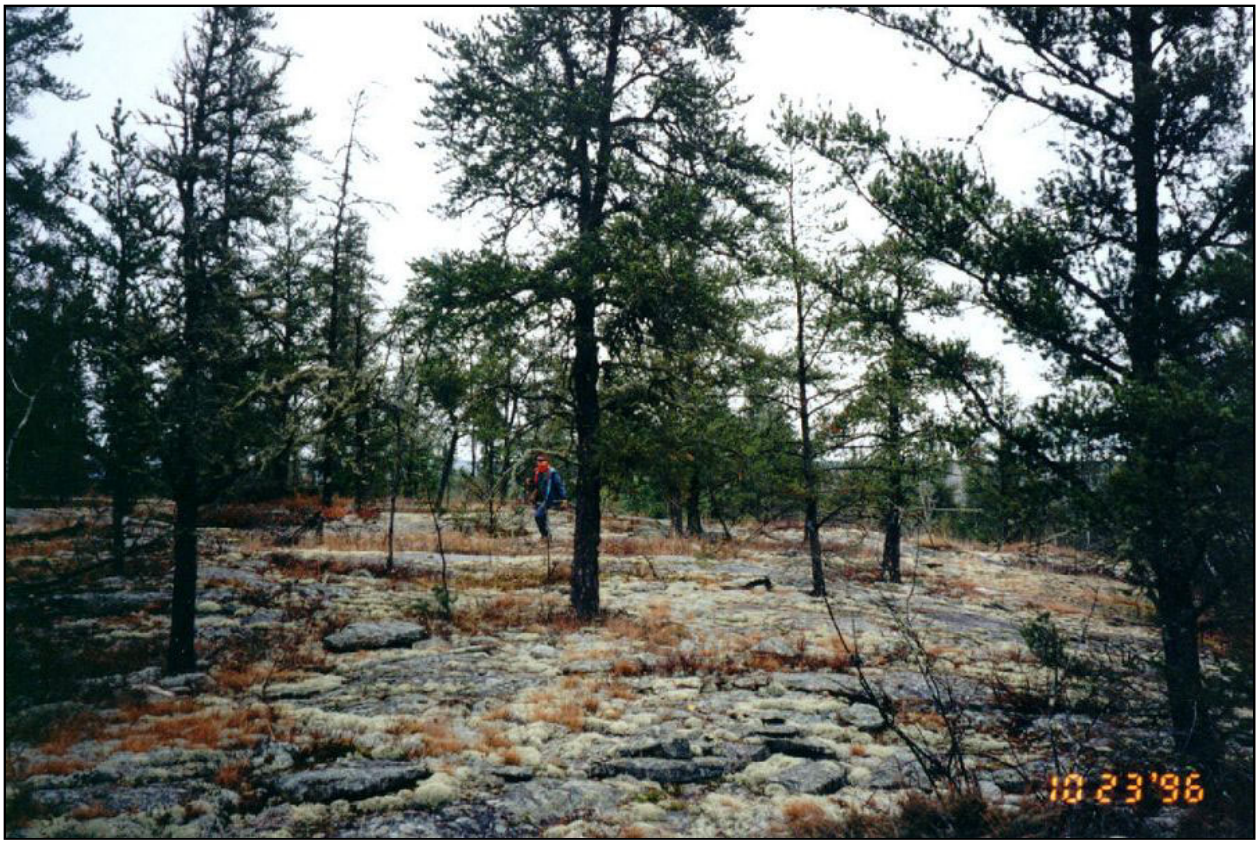
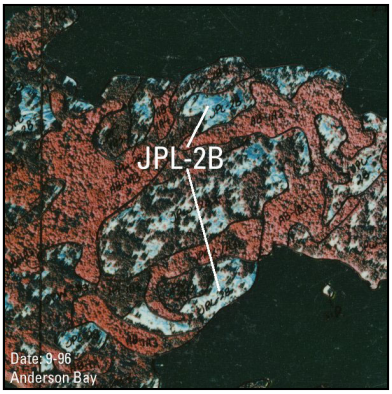


Photo credit: Kevin Hop

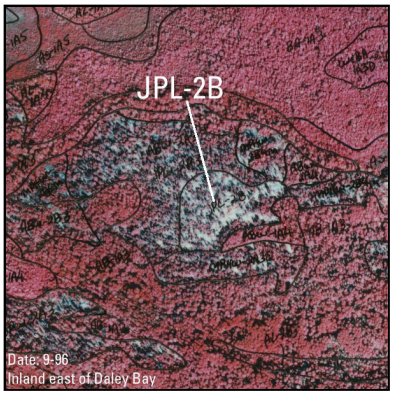
The Jack Pine/Lichen Rocky Barrens Map Unit (JPL) represents the Jack Pine/Lichen Rocky Barrens Association. This association occurs on ridge tops and high slopes with 40-80% exposed bedrock. Slopes are highly variable and range from gentle to very steep with variable aspects. Vegetation usually occurs on patches where soil has accumulated over bedrock. In this association, jack pine is the only tree dominant in the canopy, but occurs <25% total cover. A dwarf-shrub layer is nearly always present in low coverage. Lichens dominate the nonvascular cover. Mosses are also present.

JPL-2B appears as pale blue with a smooth texture and patches of dark red-brown. The pale blue is the exposed bedrock with lichens and mosses. The dark red-brown is the jack pine. The nonvascular cover is discontinuous and clumped. The photo was taken in September 1996.

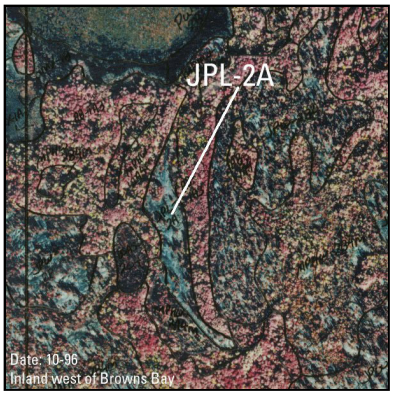


JPL - Jack Pine/Lichen Rocky Barrens

JPL-2B appears as bluish-white with a smooth texture and dark red-brown speckles. The bluish-white is the exposed bedrock with lichens and mosses. The dark red-brown is the jack pine. The nonvascular cover is discontinuous and clumped. The photo was taken in Sept 1996.



JPL-2A appears as a pale blue with a smooth texture and dark red-brown speckles. The pale blue is the exposed bedrock with lichens and mosses. The dark red-brown is the jack pine. The nonvascular cover is discontinuous and evenly dispersed. The photo was taken in October 1996.



Area Report for JPL Map Unit
Polygons: 57
Hectares: 84
Acres: 208
Average size: 1 hectare, 4 acres

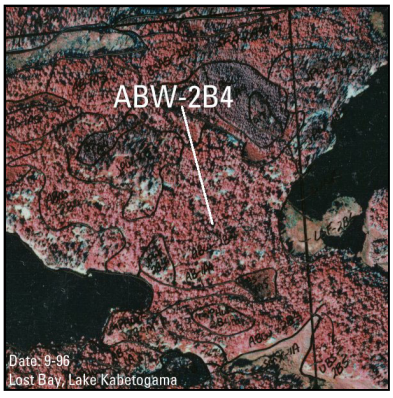
Accuracy Assessment Results for JPL Map Unit
The Jack Pine/Lichen Rocky Barrens Map Unit was assessed at 100% producers' accuracy (confidence interval 97-103%) and 84% users' accuracy (confidence interval 68-101%).

ABW - Mixed Aspen Rocky Woodland

Photo credit: Kevin Hop

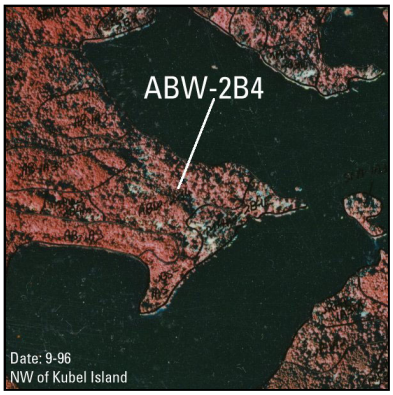
The Mixed Aspen Rocky Woodland Map Unit (ABW) represents the Mixed Aspen Rocky Woodland Association. This association occurs on bedrock ridges with shallow soils. Slopes are generally gentle with variable aspects. Exposed bedrock ranges from 5-20%. The canopy usually consists of a mix of trembling aspen, paper birch, and occasionally bigtooth aspen. Canopy closure typically ranges from 20-60%, but occasionally can be higher. Stands with >60% canopy closure are separated from the Quaking Aspen-Paper Birch Forest Map Unit (AB) by the presence of exposed bedrock.

ABW-2B4 appears as a mix of reds with patches of carpet-like texture. Bluish-white rock outcrops are scattered throughout the polygon. The canopy is open and clumped. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.

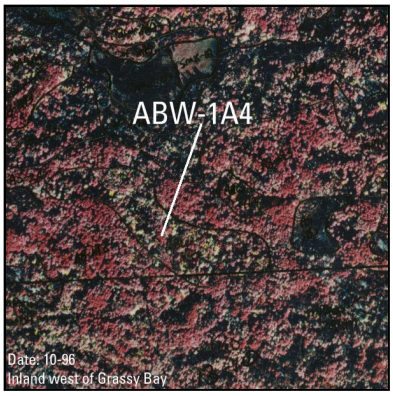


ABW - Mixed Aspen Rocky Woodland

ABW-2B4 appears as a mix of reds with patches of rough texture. Bluish-white rock outcrops are scattered throughout the polygon. The canopy is open and clumped. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.



ABW-1A4 appears as mottled reds and yellows with a rough texture. The canopy is closed and evenly dispersed. The stereo pair of photos is necessary to see small exposed bedrock and the ridge top position, which defines ABW from aspen forest types. The tree height falls within the 5-12 meter range. The photo was taken in October 1996.



Area Report for ABW Map Unit
Polygons: 856
Hectares: 1,659
Acres: 4,099
Average size: 2 hectares, 5 acres

Accuracy Assessment Results for ABW Map Unit
The Mixed Aspen Rocky Woodland Map Unit was assessed at 85% producers' accuracy (confidence interval 71-101%) and 68% users' accuracy (confidence interval 51-85%). Producers' accuracy is considered adequate as mapped. Errors in users' accuracy were primarily associated with Map Unit AB.

OW - Northern Pin Oak-Bur Oak (Jack Pine) Rocky Woodland (deciduous phase)

Photo credit: Michael Lew-Smith

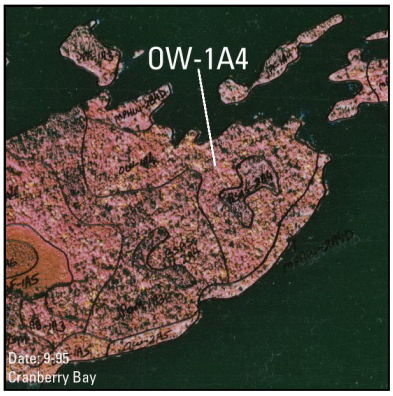
The Northern Pin Oak-Bur Oak-(Jack Pine) Rocky Woodland (deciduous phase) Map Unit (OW) represents, in part, the Northern Pin Oak - Bur Oak - (Jack Pine) Rocky Woodland Association. OW is dominated by northern pin oak with <20% of evergreens in the canopy. The canopy closure is typically open, with closed canopies quite common.

OW shares the association with the JPOM Map Unit (jack pine phase) and the MPHW Map Unit (mixed pine-oak phase). All 3 of these map units were originally thought to represent their own associations. However, upon further analysis of the vegetation data, it was determined that each of these map units actually represent the Northern Pin Oak - Bur Oak - (Jack Pine) Rocky Woodland Association, each with their unique variations.

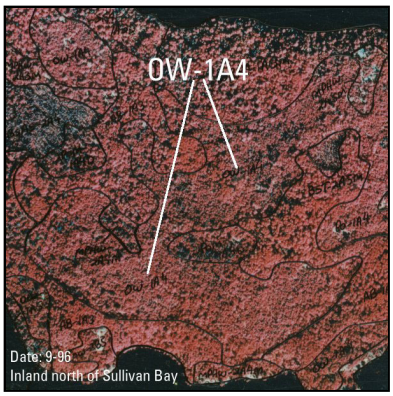
The Northern Pin Oak - Bur Oak - (Jack Pine) Rocky Woodland Association occurs on ridge tops and high slopes, and some dry, flat, rocky areas. These sites are well drained, and have exposed bedrock in the more open stands. Ancillary photographs from 1988 were used to help determine oaks from other deciduous trees. In the 1988 photo set, the oaks appear yellow, where all other deciduous trees appear white, pink or red.

OW - Northern Pin Oak-Bur Oak (Jack Pine) Rocky Woodland (deciduous phase)

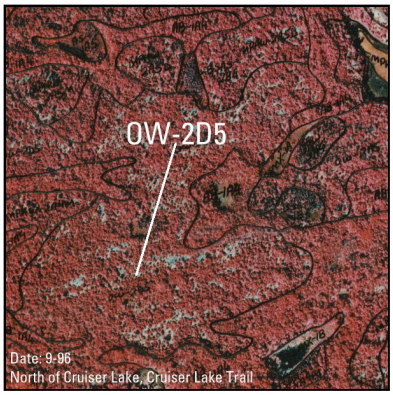
OW-1A4 appears as red-orange, pink, and yellow with a mottled and rough texture. The red-orange is the pin oak, the pinks are aspens, and the yellow is maple. The canopy is closed and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1995.



OW-1A4 appears as red-orange with a rough texture. The canopy is continuous and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.

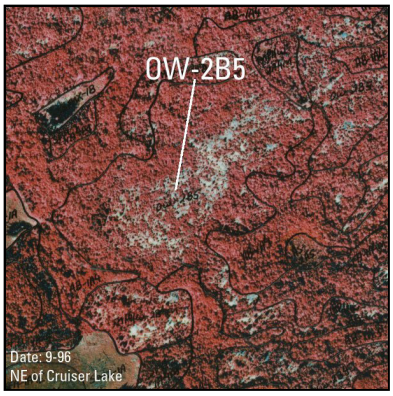


OW-2D5 appears red-orange with a rough texture and patches of bluish-white with a smooth texture. The red-orange is the pin oak and the bluish-white is exposed bedrock. The canopy is open and regularly alternating with the bedrock. The tree height falls within the 0.5-5 meter range. The photo was taken in September 1996.



OW - Northern Pin Oak-Bur Oak (Jack Pine) Rocky Woodland (deciduous phase)

OW-2B5 appears red-orange with a rough texture and bluish-white with a smooth texture. The red-orange is the pin oak, and the bluish-white is exposed bedrock. The canopy is open and clumped. The tree height falls within the 0.5-5 meter range. The photo was taken in September 1996.



Area Report for OW Map Unit
Polygons: 303
Hectares: 827
Acres: 2,044
Average size: 3 hectares, 7 acres

Accuracy Assessment Results for OW, JPOM, and MPHW Map Units
The Northern Pin Oak-Bur Oak-(Jack Pine) Rocky Woodland (deciduous phase) Map Unit was assessed with 2 other phases of the Northern Pin Oak - Bur Oak - (Jack Pine) Rocky Woodland Association: JPOM (jack pine-oak phase) and MPHW (mixed pine-oak phase). OW, JPOM, and MPHW were assessed at 99% producers' accuracy (confidence interval 96-102%) and 86% users' accuracy (confidence interval 79-92%).

JPOM - Northern Pin Oak- Bur Oak (Jack Pine) Rocky Woodland (jack pine-oak phase)

Photo credit: Kevin Hop

The Northern Pin Oak-Bur Oak-(Jack Pine) Rocky Woodland (jack pine-oak phase) Map Unit (JPOM) represents, in part, the Northern Pin Oak - Bur Oak - (Jack Pine) Rocky Woodland Association. JPOM has a canopy consisting of northern pin oak with jack pine >25% cover.

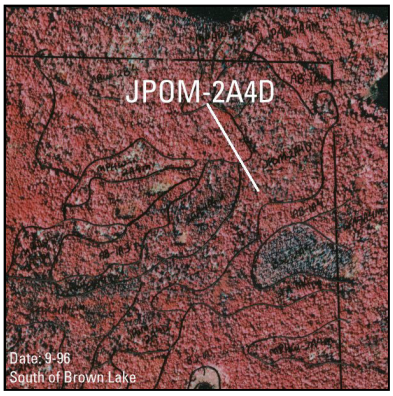
JPOM shares the association with the OW Map Unit (deciduous phase) and the MPHW Map Unit (mixed pine-oak phase). All 3 of these map units were originally thought to represent their own associations. However, upon further analysis of the vegetation data, it was determined that each of these map units actually represent the Northern Pin Oak - Bur Oak - (Jack Pine) Rocky Woodland Association, each with their unique variations.

The dominance/co-dominance modifier was used for JPOM mapping. JPOM was originally thought to be a mixed evergreen-deciduous woodland type. Even though the association it now represents is classified as deciduous forest and not mixed evergreen-deciduous forest, the modifier was preserved to show the amounts of jack pine.

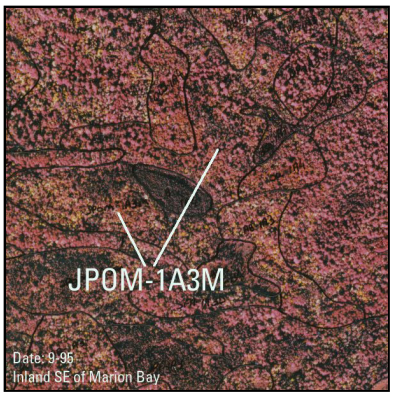
This association occurs on ridge tops and high slopes, and some dry, flat, rocky areas. These sites are well drained, and have exposed bedrock in the more open stands. Ancillary photographs from 1988 were used to help determine oaks from other deciduous trees. In the 1988 photo set, the oaks appear yellow, where all other deciduous trees appear white, pink or red.

JPOM - Northern Pin Oak- Bur Oak (Jack Pine) Rocky Woodland (jack pine-oak phase)

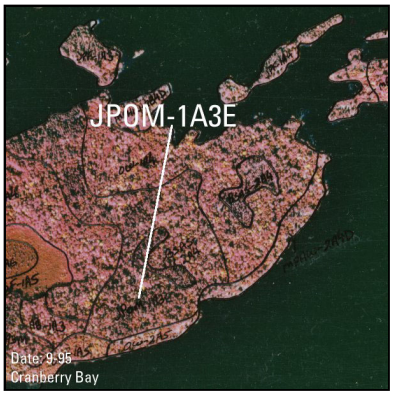
JPOM-2A4D appears as orange-red with a rough texture and patches of dark red-brown. The orange-red is the pin oak and the dark red-brown is the jack pine. Small bluish-white patches of exposed bedrock are also visible. The canopy is open and evenly dispersed. The tree height, which reflects the supra-canopy of jack pine, falls within the 5-12 meter range. Pin oak (< 5 meters tall) is 60-75% of the total tree cover with the jack pine 25-40%. The photo was taken in September 1996.



JPOM-1A3M appears as a mix of various reds, pinks, and yellows with a rough texture. The canopy is closed and evenly dispersed. The tree height, which reflects the supra-canopy of the jack pine, falls within the 12-20 meter range. The pin oak and the jack pine share dominance. The photo was taken in September 1995.



JPOM-1A3E appears as a mix of various reds and dark red-brown with a rough texture. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range. Jack pine dominate with 60-75% of the total tree cover with pin oak and aspen 25-40%. The photo was taken in September 1995.



Area Report for JPOM Map Unit
Polygons: 34
Hectares: 77
Acres: 190
Average size: 2 hectares, 6 acres

Accuracy Assessment Results for JPOM, MPHW, and OW Map Units
The Northern Pin Oak-Bur Oak-(Jack Pine) Rocky Woodland (jack pine-oak phase) Map Unit was assessed with 2 other phases of the Northern Pin Oak - Bur Oak - (Jack Pine) Rocky Woodland Association: OW (deciduous phase) and MPHW (mixed pine-oak phase). JPOM, OW, and MPHW were assessed at 99% producers' accuracy (confidence interval 96-102%) and 86% users' accuracy (confidence interval 79-92%).

MPHW - Northern Pin Oak- Bur Oak (Jack Pine) Rocky Woodland (mixed pine-oak phase)

Photo credit: Michael Lew-Smith

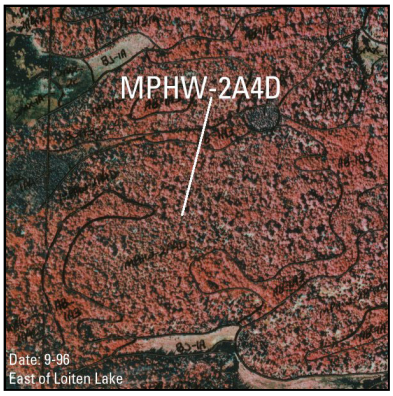
The Northern Pin Oak-Bur Oak-(Jack Pine) Rocky Woodland (mixed pine-oak phase) Map Unit (MPHW) represents, in part, the Northern Pin Oak - Bur Oak - (Jack Pine) Rocky Woodland Association. MPHW has a canopy with >25% hardwoods (oaks, aspens, and birch) and >25% conifers (pines, spruce, fir, cedar).

MPHW shares the association with the OW Map Unit (deciduous phase) and the JPOM Map Unit (jack pine phase). All 3 of these map units were originally thought to represent their own associations. However, upon further analysis of the vegetation data, it was determined that each of these map units actually represent the Northern Pin Oak - Bur Oak - (Jack Pine) Rocky Woodland Association, each with their unique variations.

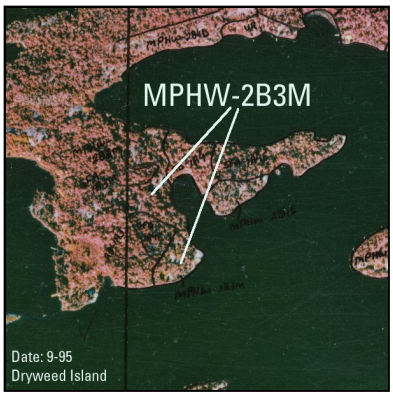
The dominance/co-dominance modifier was used for MPHW mapping. MPHW was originally thought to be a mixed evergreen-deciduous woodland type. Even though the association it now represents is classified as deciduous forest and not mixed evergreen-deciduous forest, the modifier was preserved to show the amounts of evergreen and deciduous trees and shrubs.

This association occurs on ridge tops and high slopes, and some dry, flat, rocky areas. These sites are well drained, and have exposed bedrock in the more open stands. Ancillary photographs from 1988 were used to determine oaks from other deciduous trees. In the 1988 photo set, the oaks appear yellow, where all other deciduous trees appear white, pink or red.

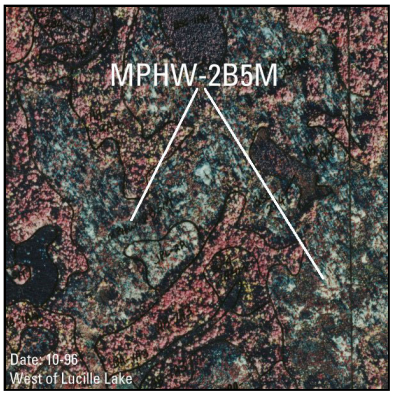
MPHW - Northern Pin Oak-Bur Oak (Jack Pine) Rocky Woodland (mixed pine-oak phase)



MPHW-2A4D appears as red and red-orange with a rough texture. The canopy is open and evenly dispersed. The tree height falls within the 5-12 meter range. The deciduous component (mostly of pin oak) is 60-75% of the total tree cover with evergreens 25-40%. The photo was taken in September



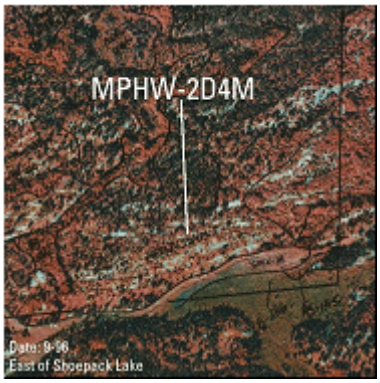
MPHW-2B3M appears as pink, red-orange, and dark gray with a mottled texture. Small bluish-white patches of exposed bedrock are also visible. The canopy is open and clumped. The tree height falls within the 12-20 meter range. Deciduous and evergreen trees and shrubs share dominance. The photo was taken in September 1995.



MPHW-2B5M appears as dark blue, pale blue, white, and splotches of red with a mottled texture. The canopy is open and clumped. The tree height falls within the 0.5-5 meter range. The area was formerly jack pine woodland, but has since been affected by disease and blowdown. It is now dominated with various shrubs and trees. The photo was taken in October 1996.

MPHW - Northern Pin Oak-Bur Oak (Jack Pine) Rocky Woodland (mixed pine-oak phase)

MPHW-2D4M appears as dark red-brown, orange-brown, and bluish-white. The canopy is open and regularly alternating. The tree height falls within the 5-12 meter range. Deciduous and evergreen trees and shrubs share dominance. The photo was taken in September 1996.



Area Report for MPHW Map Unit
Polygons: 1,472
Hectares: 3,713
Acres: 9,176
Average size: 3 hectares, 6 acres

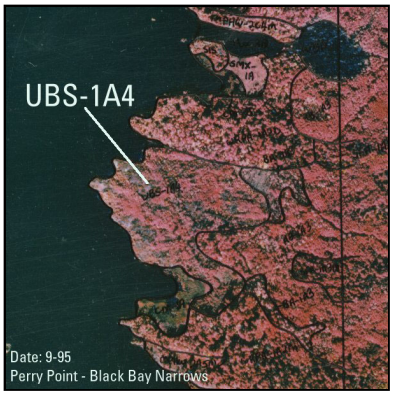
Accuracy Assessment Results for MPHW, JPOM, and OW Map Units
The Northern Pin Oak-Bur Oak-(Jack Pine) Rocky Woodland (mixed pine-oak phase) Map Unit was assessed with 2 other phases of the Northern Pin Oak - Bur Oak - (Jack Pine) Rocky Woodland Association: OW (deciduous phase) and JPOM (jack pine-oak phase). MPHW, OW, and JPOM, were assessed at 99% producers' accuracy (confidence interval 96-102%) and 86% users' accuracy (confidence interval 79-92%).

UBS - Boreal Hazelnut-Serviceberry Rocky Shrubland

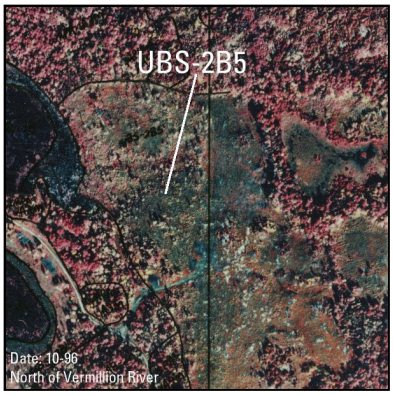
Photo credit: Michael Lew-Smith

The Boreal Hazelnut-Serviceberry Rocky Shrubland Map Unit (UBS) represents the Boreal Hazelnut - Serviceberry Rocky Shrubland Association. This association occurs on a wide variety of slopes, soils, topographic positions and moisture regimes. This association typically arises because of natural or human disturbance such as beaver activities, fire, logging, or blowdowns. This association can also occur without disturbance, as small ridge top stands. Composition usually contains a dense (70-90% cover) shrub canopy of hazelnut, mountain maple, trembling aspen, and balsam fir.

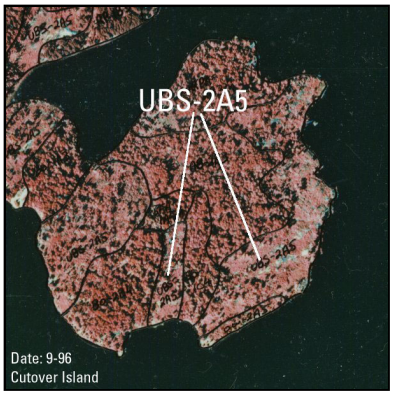
UBS-1A4 appears pink, orange, and gray with a sculpting texture. The canopy is closed and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1995.



UBS - Boreal Hazelnut-Serviceberry Rocky Shrubland



UBS-2B5 appears as mottled greens and pinks with a somewhat pitted texture. The shrub cover is open and clumped. The shrub height ranges from 0.5-5 meters. The photo was taken in October 1996.



UBS-2A5 appears as light pink with a somewhat smooth texture. The shrub cover is discontinuous and evenly dispersed. The shrub height falls within the 0.5-5 meter range. The photo was taken in September 1996.

Area Report for UBS Map Unit
Polygons: 598
Hectares: 1,518
Acres: 3,750
Average size: 3 hectares, 6 acres

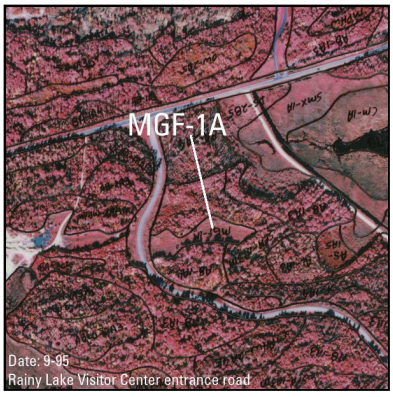
Accuracy Assessment Results for UBS Map Unit
The Boreal Hazelnut-Serviceberry Rocky Shrubland Map Unit was assessed at 90% producers' accuracy (confidence interval 80-101%) and 88% users' accuracy (confidence interval 76-99%).

MGF - Poverty Grass Granite Barrens

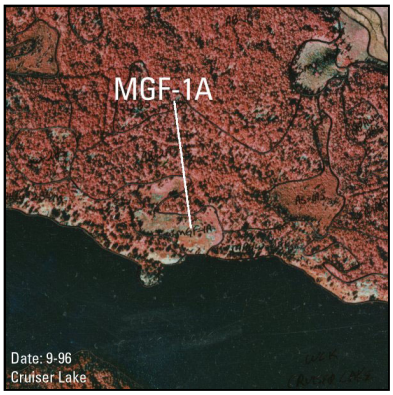
Photo credit: Michael Lew-Smith

The Poverty Grass Granite Barrens Map Unit (MGF) represents the Poverty Grass Granite Barrens Association. This type was not described for Voyageurs but occurs primarily on disturbed sites around abandoned cottages. A variety of native and exotic species can be found on these sites. It occurs mainly on private lands, islands within Kabetogama Lake, and a few other locations within the park.

MGF-1A appears a light red with a smooth, even texture. The herbaceous cover is continuous and evenly dispersed. The photo was taken in September 1995.



MGF - Poverty Grass Granite Barrens



MGF-1A appears as orange and light olive green with a smooth texture. Bluish-white rock outcrops are visible. The herbaceous cover is continuous and evenly dispersed. The photo was taken in September 1996.

Area Report for MGF Map Unit
Polygons: 113
Hectares: 116
Acres: 286
Average size: 1 hectare, 3 acres

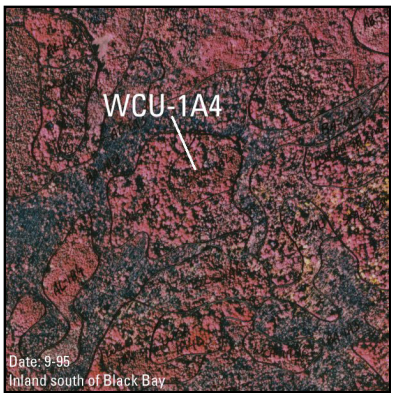
Accuracy Assessment Results for MGF Map Unit
The Poverty Grass Granite Barrens Map Unit was assessed at 100% producers' accuracy (confidence interval 83-117%) and 100% for users' accuracy (83-117%)

WCU - White Cedar-Boreal Conifer Mesic Forest

Photo credit: Kevin Hop

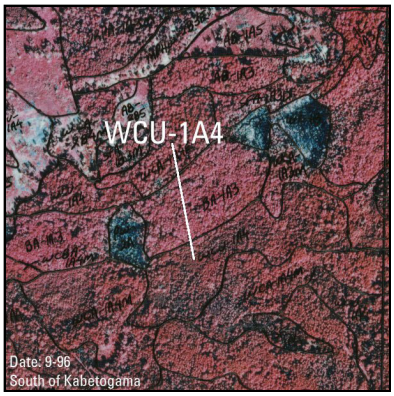
The White Cedar-Boreal Conifer Mesic Forest Map Unit (WCU) represents the White Cedar - Boreal Conifer Mesic Forest Association. This association occurs in small patches in localized areas, typically on moderate slopes. This type also occurs on flat terrain over deep, poorly drained silt clay loams and on gently sloping terrain, often on toeslopes located just above wetland communities. The soils are typically loams over dense lacustrine clay. A shallow build-up of decomposed peat may be present. This association generally exhibits a completely closed canopy of white cedar. Black ash, and less commonly, balsam poplar and trembling aspen may also occur in the canopy or emergent layers with <25% cover.

WCU-1A4 appears red and orange red with a fine texture. The canopy is closed and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1995.

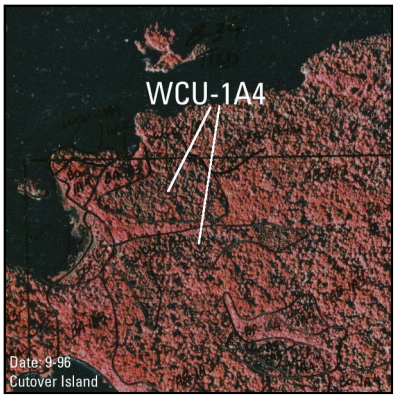


WCU - White Cedar-Boreal Conifer Mesic Forest

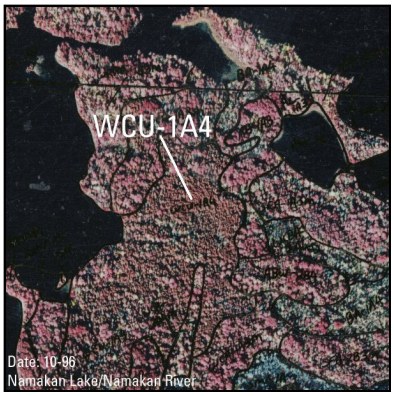
WCU-1A4 appears as orange-red, pink, and blue-magenta with a fine texture. The canopy is closed and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.



WCU-1A4 appears as a orange-red and dark red with a medium to fine texture. The canopy is closed and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.



WCU-1A4 appears as pale rust, blue, and pink with a fine texture. The canopy is closed and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in October 1996.



Area Report for WCU Map Unit
Polygons: 324
Hectares: 488
Acres: 1,207
Average size: 2 hectares, 4 acres

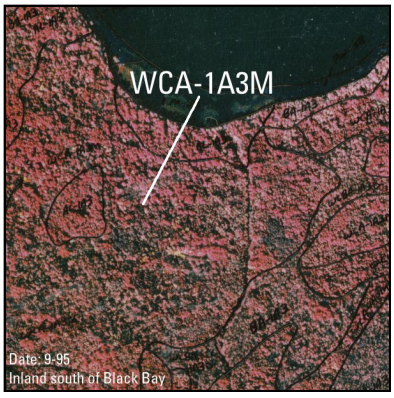
Accuracy Assessment Results for WCU Map Unit
The White Cedar-Boreal Conifer Mesic Forest Map Unit was assessed at 88% producers' accuracy (confidence interval 75-101%) and 88% users' accuracy (confidence interval 76-101%)

WCA - White Cedar-Yellow Birch Forest

Photo credit: Michael Lew-Smith

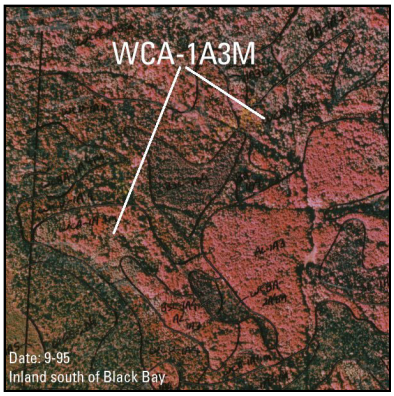
The White Cedar-Yellow Birch Forest Map Unit (WCA) represents the White Cedar – Yellow Birch Forest Association. This association occurs on flat or gently sloping terrain with variable aspects. It frequently occupies toeslopes located just above wetland communities. Soils contain a shallow organic layer over loam over dense lacustrine clay. This association is dominated by a canopy of white cedar with lesser amounts of balsam fir.

WCA-1A3M appears as red-orange and gray with a rough to medium texture. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in September 1995.

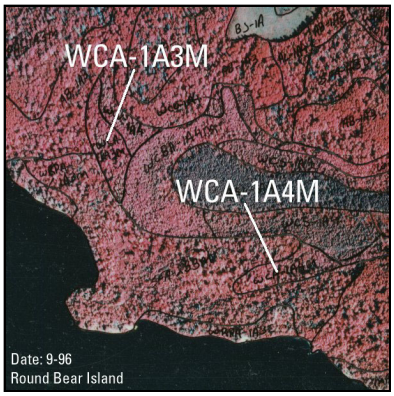


WCA - White Cedar-Yellow Birch Forest

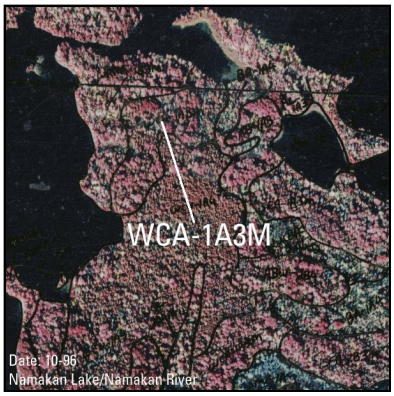
WCA-1A3M appears as red-orange and gray with a rough to medium texture. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in September 1995.



WCA-1A3M and WCA-1A4M appear as red-orange and gray with a rough to medium texture. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range and the 5-12 meter range. The photo was taken in September 1996.



WCA-1A3M appears as dark pink and rust-gray with a varied texture. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range and the 5-12 meter range. The photo was taken in September 1996.



Area Report for WCA Map Unit
Polygons: 384
Hectares: 1,010
Acres: 2,496
Average size: 2 hectares, 6 acres

Accuracy Assessment Results for WCA Map Unit
The White Cedar Boreal Conifer Mesic Forest Map Unit was assessed at 93% producers' accuracy (confidence interval 84-103%) and 79% users' accuracy (confidence interval 71-96%).

JPAX - Jack Pine-Aspen Forest Mosaic

Photo credit: Kevin Hop

The Jack Pine-Aspen Forest Mosaic Map Unit (JPAX) represents not only the Jack Pine - Aspen / Bush Honeysuckle Forest Association, but also a combination of the Jack Pine / Balsam Fir Forest Association with either or both the Aspen-Birch / Boreal Conifer Forest Association and Aspen - Birch - Red Maple Forest Association.

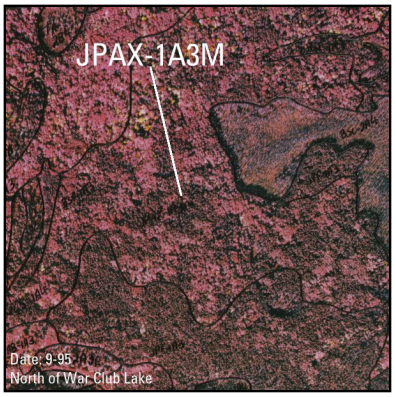
A polygon mapped as JPAX most commonly is a combination of Jack Pine / Balsam Fir Forest and Aspen-Birch / Boreal Conifer Forest. Even with the addition of the Aspen - Birch - Red Maple Forest, the JPAX Map Unit used this way is actually a combination of the JPF and AB Map Units.

When JPAX was used to map a combination of jack pine and aspen forest types, it was mapped as such because forests occurred in a mosaic pattern with each other. The jack pine forest type often occurs on ridge tops with dry, thin soils over bedrock. The aspen forest types often occur on hillsides and shallow valleys where the soils are more developed and mesic. These habitats are of patchy occurrence, creating a mosaic of forest types too intricate to map comfortably. Instead, a secondary minimum mapping unit of 2-5 ha size was used to map these forests when in a mosaic pattern with each other. When the individual forests fall within or below this range, this mosaic-mapping guide was applied.

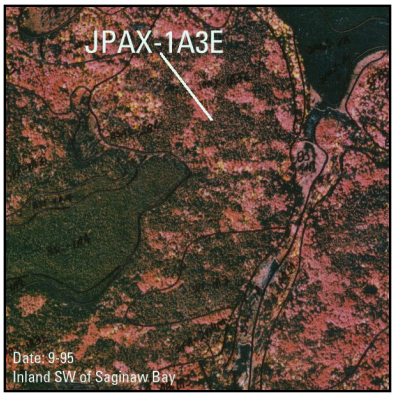
The Jack Pine - Aspen / Bush Honeysuckle Forest Association occurs on well-drained somewhat rocky upland sites. This association classifies as a true mix of jack pine and aspen trees. These true mix situations were seen as less common during the mapping.

JPAX - Jack Pine-Aspen Forest Mosaic

JPAX-1A3M appears light red with a billowy texture to dark red with a fine texture. The light red is the aspen and the dark red is the jack pine. The jack pine and aspen forests are arranged in a mosaic pattern. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range. Evergreen and deciduous forest types share dominance within the polygon. The photo was taken in September 1995.

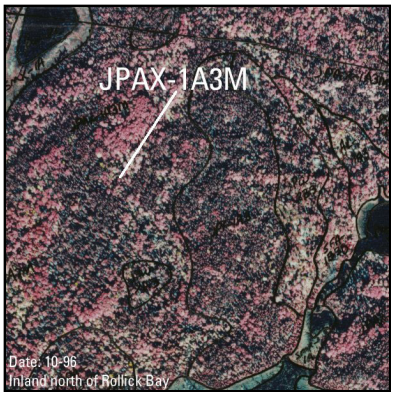


JPAX-1A3E appears light red with a billowy texture to dark red with a fine texture. The jack pine and aspen forests are arranged in a mosaic pattern. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range. The individual jack pine forests cover 60-75% of the polygon, where the aspen forests cover 25-40%. The photo was taken in September 1995.



JPAX-1A3M appears light red with a billowy texture to dark blue-red with a fine texture. The jack pine and aspen forests are arranged in a mosaic pattern. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range. Evergreen and deciduous forest types share dominance within the polygon. The photo was taken in September 1996.

JPAX - Jack Pine-Aspen Forest Mosaic



JPAX-1A3M appears light red with a billowy texture to dark blue-red with a fine texture. The jack pine and aspen forests are arranged in a mosaic pattern. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range. Evergreen and deciduous forest types share dominance within the polygon. The photo was taken in September 1996.

Area Report for JPAX Map Unit
Polygons: 715
Hectares: 4,592
Acres: 11,348
Average size: 6 hectares, 16 acres

Accuracy Assessment Results for JPAX Map Unit
The Jack Pine-Aspen Forest Mosaic Map Unit was assessed at 83% producers' accuracy (confidence interval 69-96%) and 80% users' accuracy (confidence interval 66-94%).

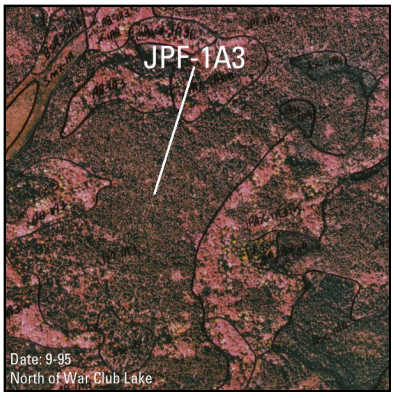
JPF - Jack Pine/Balsam Fir Forest

Photo credit: Kevin Hop

The Jack Pine/Balsam Fir Forest Map Unit (JPF) represents the Jack Pine / Balsam Fir Forest Association. This association occurs on well-drained, somewhat rocky upland sites. Soils are typically well drained loams or sandy loams. Surficial bedrock outcrops are common. The canopy usually consists solely of jack pine and ranges from 60-80% cover.

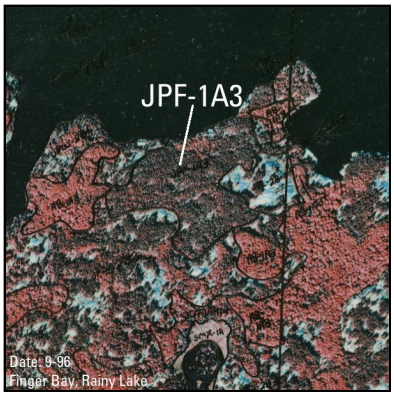
This association is also included in the JPAX Map Unit when it occurs as a mosaic pattern with either one or both the Aspen Birch/Boreal Conifer Forest Association and the Aspen - Birch - Red Maple Forest Association (see description for JPAX).

JPF-1A3 appears as a brown signature with a fine texture in this photo. The canopy is continuous and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in September 1995.

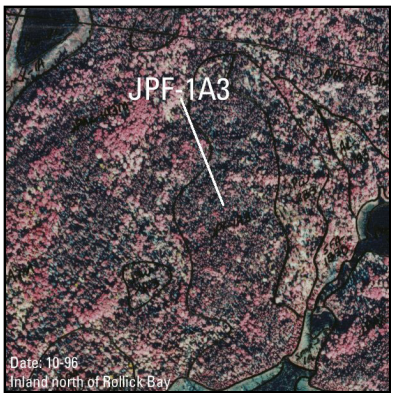


JPF - Jack Pine/Balsam Fir Forest

JPF-1A3 appears as gray with a fine texture in this photo. The canopy is continuous and evenly dispersed, with a few small openings revealing rocky outcrops. The tree height falls within the 12-20 meter range. The photo was taken in September 1996.



JPF-1A3 appears as gray and pink with a fine texture in this photo. The canopy coverage is continuous and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in October 1996.



Area Report for JPF Map Unit
Polygons: 909
Hectares: 2,502
Acres: 6,183
Average size: 3 hectares, 7 acres

Accuracy Assessment for JPF Map Unit
The Jack Pine/Balsam Fir Forest Map Unit was assessed at 93% producers' accuracy (confidence interval 82-103%) and 78% users' accuracy (confidence interval (65-92%). Producers' accuracy is considered adequate as mapped. Errors in users' accuracy were primarily associated with Map Units BSF and WP, and with Map Unit JPAX when assessed as the Jack Pine - Aspen / Bush Honeysuckle Forest Association.

WRPA - White Pine-Red Pine-Quaking Aspen-Paper Birch Forest

Photo credit: Kevin Hop

The White Pine-Red Pine-Quaking Aspen-Paper Birch Forest Map Unit (WRPA) represents not only two associations within the White Pine (Red Pine) - Quaking Aspen Forest Alliance (White Pine - Aspen - Birch Forest and Red Pine Aspen Birch Forest), but also a combination of either or both the Red Pine / Blueberry Dry Forest Association and the White Pine / Mountain Maple Mesic Forest Association with either or both the Aspen-Birch / Boreal Conifer Forest Association and the Aspen - Birch - Red Maple Forest Association.

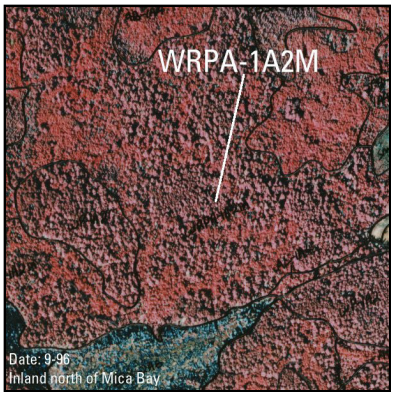
When WRPA was used to map a combination of pine and aspen forest types, it was mapped as such because the forests occurred in a mosaic pattern with each other. The pine forest types occur in different habitats than the aspen forests types. These habitats are of patchy occurrence, creating a mosaic of forest types too intricate to map comfortably. Instead, a secondary minimum mapping unit of 2-5 ha size was used to map these forests when in a mosaic pattern with each other. When the individual forests fall within or below this range, this mosaic-mapping guide was applied.

WRPA is thought to represent about half the polygons as a mosaic of pine and aspen forest types. Another way to describe WRPA when mapped as a mosaic is by the combinations of the RP and/or WP Map Units with the AB Map Unit. The other half of the polygons represents the White Pine (Red Pine) - Quaking Aspen Forest Alliance, which occurs on well-drained somewhat rocky upland sites. This alliance classifies as a true mix of pines and aspen trees.

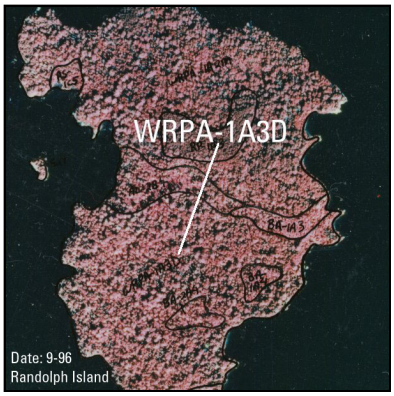
WRPA - White Pine-Red Pine-Quaking Aspen-Paper Birch Forest

WRPA-1A2M appears in various shades of red and pink with a coarse texture. This polygon shows both a true mixed forest type and mosaic mapping of forest types (e.g. larger red patch of pines). The canopy coverage is continuous and evenly dispersed. The height of the pines falls within the 20–30 meter range, with the aspen being shorter. Evergreen and deciduous trees and forest types share dominance within the polygon. The photo was taken in September 1995.

WRPA-1A2M appears as red-orange and purple-red with a mottled, rough texture. The red-orange is the aspen and the purple red are the pines. This polygon shows mosaic mapping of forest types. The canopy coverage is continuous and evenly dispersed. The height of the pines falls within the 20–30 meter range, with the aspen being shorter. Evergreen and deciduous forest types share dominance within the polygon. The photo was taken in September 1996.



WRPA-1A3D appears pink and red with a rough texture. The pink is the aspen and the red are the pines. The canopy coverage is continuous and evenly dispersed. The tree height falls within the 12-20 meter range. The individual aspen forests cover 60-75% of the polygon, where the pine forests cover 25-40%. The photo was taken in September 1996.



WRPA - White Pine-Red Pine-Quaking Aspen-Paper Birch Forest

WRPA-1A3E appears orange-red and dark red-brown with a rough texture. The canopy coverage is continuous and evenly dispersed. The tree height falls within the 12-20 meter range. The individual pine forests cover 60-75% of the polygon, where the aspen forests cover 25-40%. The photo was taken in September 1996.

Area Report for WRPA Map Unit
Polygons: 1,486
Hectares: 9,823
Acres: 24,274
Average size: 7 hectares, 16 acres

Accuracy Assessment Results for WRPA Map Unit
The White Pine-Red Pine-Quaking Aspen-Paper Birch Forest Map Unit was assessed at 85% producers' accuracy (confidence interval 74-96%) and 94% users' accuracy (confidence interval 87-

RP - Red Pine-Blueberry Dry Forest

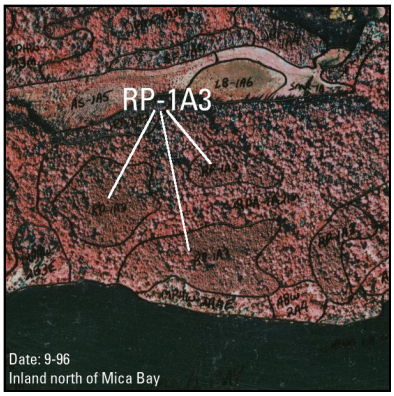
Photo credit: Kevin Hop

The Red Pine-Blueberry Dry Forest Map Unit (RP) represents the Red Pine / Blueberry Dry Forest Association. This association is found throughout the park on dry, rocky sites with gentle to moderate slopes (5-20%) and variable aspects. Soils are loams or sandy loams. The substrate is typically dry and very rocky. Canopy coverage is either solely of red pine, or a mixture of red and white pine. A shrub layer, if present, comprises low cover of balsam fir, hazelnut, red maple, white pine, and service- berries. Blueberries are common dwarf-shrubs.

This association is also included in the WRPA Map Unit when it occurs as a mosaic pattern with either one or both the Aspen Birch/Boreal Conifer Forest and the Aspen - Birch - Red Maple Forest Associations (see description for WRPA).

RP-1A2 appears red-orange with a grainy to coarse texture. The canopy coverage is continuous and evenly dispersed. The tree height falls within the 20-30 meter range. A couple of rock outcrops are visible near the water's edge. The photo was taken in September 1995.

RP - Red Pine-Blueberry Dry Forest



RP-1A3 appears as dull red with a somewhat fine-grained texture. The canopy coverage is continuous and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in September 1996.

RP-1A3 appears dark purple-red with a somewhat fine-grained texture. The canopy coverage is continuous and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in October 1996.

Area Report for RP Map Unit
Polygons: 289
Hectares: 594
Acres: 1,468
Average size: 2 hectares, 5 acres

Accuracy Assessment Results for RP Map Unit
The Red Pine-Blueberry Dry Forest Map Unit was assessed at 85% producers' accuracy (confidence interval 72-98%) and 88 % producers' accuracy (confidence interval 76-101%)

WP - White Pine/Mountain Maple Forest

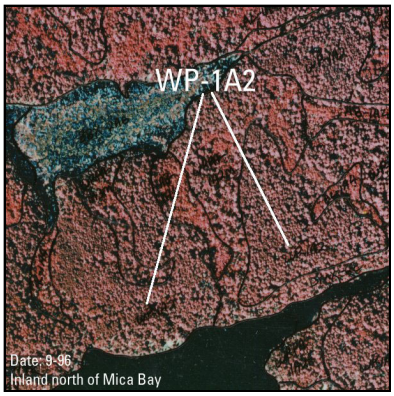
Photo credit: Michael Lew-Smith

The White Pine/Mountain Maple Forest Map Unit (WP) represents the White Pine / Mountain Maple Mesic Forest Association. This association occurs on gentle slopes with variable aspects. Small patches of exposed bedrock are occasionally present. Soils are somewhat shallow (3-10 cm deep) loams or sandy loams. The canopy consists of a mix of white pine and red pine, with white pine comprising at least 40% of the relative cover.

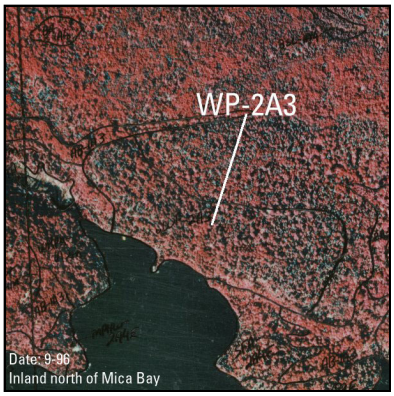
This association is also included in the WRPA Map Unit when it occurs as a mosaic pattern with either one or both the Aspen Birch/Boreal Conifer Forest and the Aspen - Birch - Red Maple Forest Associations (see description for WRPA).

WP-1A2 appears red and dark grays with a coarse texture. The red is the white pine and the dark grays are shadows over the understory. The canopy coverage is continuous and evenly dispersed. The tree height falls within the 20-30 meter range. The photo was taken in September 1995.

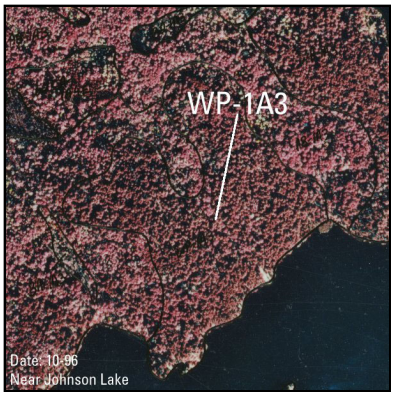
WP - White Pine/Mountain Maple Forest



WP-1A2 appears medium-dark red with a somewhat coarse texture. The canopy coverage is continuous and evenly dispersed. The tree height falls within the 20-30 meter range. The photo was taken in September 1996.



WP-2A3 appears medium red with flecks of blue-gray and a coarse texture. The white pine forest in this polygon is affected by blowdown, which the blue-gray reflects. The canopy coverage is discontinuous and clumped. The tree height falls within the 12-20 meter range. The photo was taken in September 1996.



WP-1A3 appears medium-dark red with a coarse texture. The canopy coverage is continuous and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in October 1996.

Area Report for WP Map Unit
Polygons: 645
Hectares: 1,728
Acres: 4,271
Average size: 3 hectares, 7 acres

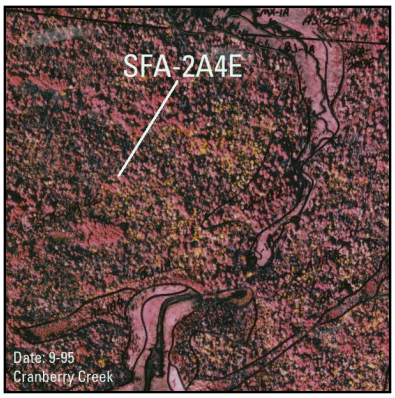
Accuracy Assessment Results for WP Map Unit
The White Pine/Mountain Maple Forest Map Unit was assessed at 89% producers' accuracy (confidence interval 77-101%) and 75% users' accuracy (confidence interval 61-89%). Producers' accuracy is considered adequate as mapped. Errors in users' accuracy were primarily associated with Map Unit RP and with Map Unit WRPA when assessed as pine - aspen mixed forest types.

SFA - Spruce-Fir-Aspen Forest

Photo credit: Kevin Hop

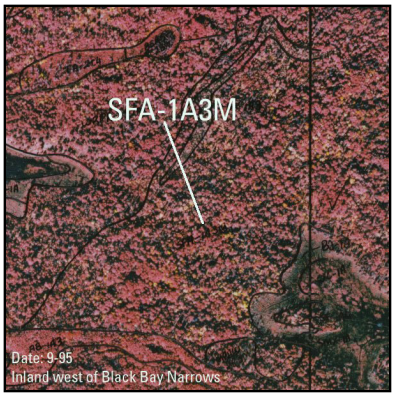
The Spruce-Fir-Aspen Forest Map Unit (SFA) represents two associations: The Spruce - Fir - Aspen Forest Association and the Black Spruce - Aspen Forest Association. The latter is uncommon and localized. This Spruce – Fir – Aspen Forest Association is common throughout the park and almost always occurs on gentle slopes with variable aspects. Bedrock and coarse surficial rocks are common. Soils are usually rocky, shallow sandy loams. A mix of trembling aspen, paper birch, white spruce, and balsam fir dominates the canopy. Both the deciduous and evergreen components comprise at least 25% of the canopy. This association characteristically contains large gaps in the canopy allowing for significant shrub layers. Much of this open canopy is due to disease and blowdown.

SFA-2A4E appears dark red, orange-red, and yellow with a choppy texture. The dark red are the spruce, the orange-red is the aspen, and the yellow is maple. The canopy is open and evenly dispersed. The tree height falls within the 4-12 meter range. The spruce and fir dominate over the aspen in this polygon. The photo was taken in September 1995.

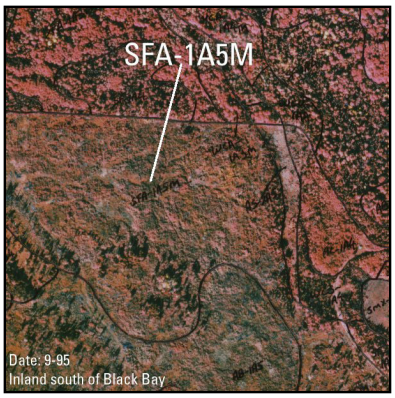


SFA - Spruce-Fir-Aspen Forest

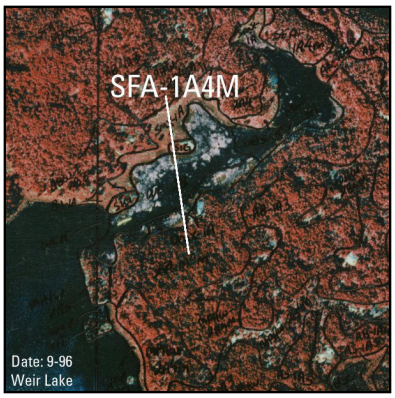
SFA-1A3M appears as dark red, red-orange, and speckles of blue-gray with a somewhat coarse and choppy texture. The dark red is the spruce and the red-orange is the aspen. The blue-gray is fir dying and other understory species. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range. The spruce and fir share dominance with the aspen. The photo was taken in September 1995.



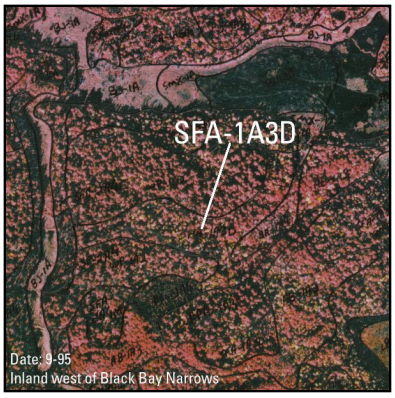
SFA-1A5M appears as orange and gray with a somewhat pitted texture. The canopy is closed and evenly dispersed. The tree height falls within the 0.5-5 meter range. The spruce and fir share dominance with the aspen. This polygon is a cutover area regenerating back to spruce, fir, and aspen. The photo was taken in September 1995.



SFA-1A4M appears as dark red and orange-red with a medium texture. The canopy is closed and evenly dispersed. The tree height falls within the 5-12 meter range. The spruce and fir share dominance with the aspen. The photo was taken in September 1996.

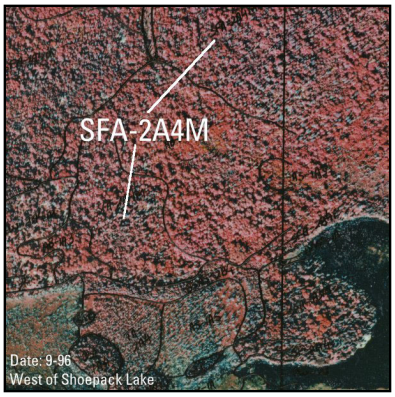


SFA-1A3D appears as red and dark red with dots of yellow and a medium grained texture. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range. The aspen dominate over the spruce and fir in this polygon. The photo was taken in September 1995.

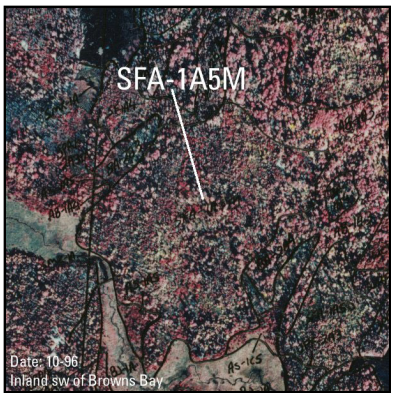


SFA - Spruce-Fir-Aspen Forest

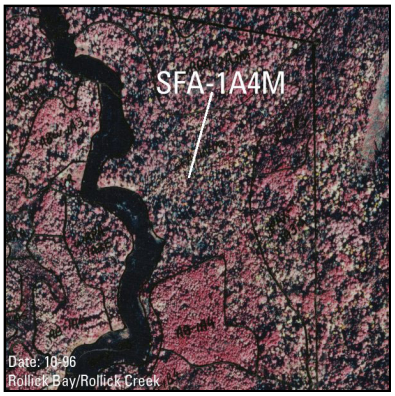
SFA-2A4M appears as blue and orange-red with a mottled texture. The canopy is open and evenly dispersed due to disease and blowdown. The tree height falls within the range of 5-12 meters. The spruce and fir share dominance with the aspen. The photo was taken in September 1996.



SFA-1A5M appears as a mottled purple, pink, and orange-red with a mottled texture. The canopy is open and evenly dispersed. The tree height falls within the range of 5-12 meters. The spruce and fir share dominance with the aspen. The photo was taken in October 1996.



SFA-2A4M appears as a mottled purple and pink with patches of light yellow and a mottled texture. The canopy is closed and evenly dispersed. The tree height falls within the range of 5-12 meters. The spruce and fir share dominance with the aspen. The photo was taken in October 1996.



Area Report for SFA Map Unit
Polygons: 2,649
Hectares: 12, 225
Acres: 30,209
Average size: 5 hectares, 11 acres

Accuracy Assessment Results for SFA Map Unit
The Spruce-Fir-Aspen Forest Map Unit was assessed at 67% producers' accuracy (confidence interval 54-79%) and 71% users' accuracy (confidence interval 59-83%). Errors in producers' accuracy were primarily associated with Map Units JPAX and SF. Errors in users' accuracy were primarily associated with Map Unit AB.

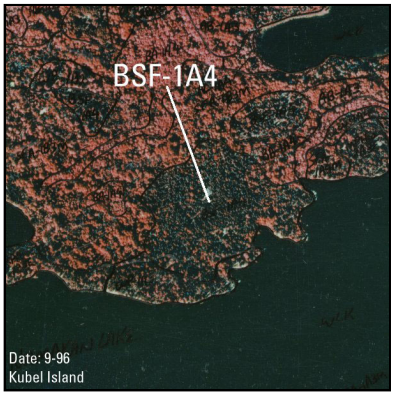
BSF - Black Spruce/Feathermoss Forest

Photo credit: Kevin Hop

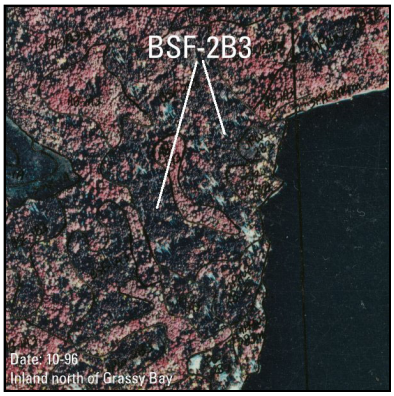
The Black Spruce/Feathermoss Forest Map Unit (BSF) represents the Black Spruce / Feathermoss Forest Association. This association is found on flat to very steep (35% slope) terrain often with a northerly aspect. It can also occur on ridge tops where shallow soils have developed down slope from open bedrock. The terrain is usually very rocky, the rocks often covered by feathermoss. Patches of exposed bedrock are common. The soils are shallow sandy or silt loams. The canopy is dominated by black spruce. Paper birch and trembling aspen can also occur at low cover.

BSF-1A3 appears as a dark olive with a fine nubby texture. The coverage is continuous and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in September 1995.

BSF - Black Spruce/Feathermoss Forest



BSF-1A4 appears as dark blue-gray with a fine nubby texture. The canopy is continuous and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.



BSF-2B3 appears as a dark blue-purple with splotches of light blue and a fine nubby texture. The dark blue-purple is the black spruce and the light blue is exposed bedrock. The canopy is discontinuous and clumped. Tree height falls within the 12-20 meter range. The photo was taken in October 1996.

Area Report for BSF Map Unit
Polygons: 406
Hectares: 551
Acres: 1,360
Average size: 1 hectare, 3 acres

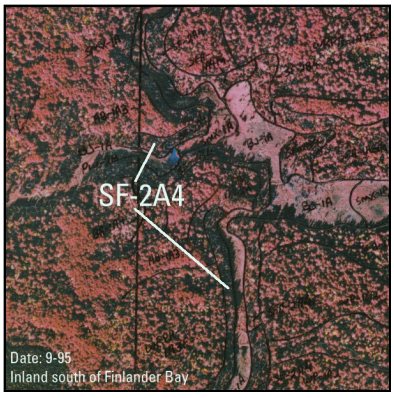
Accuracy Assessment Results for BSF Map Unit
The Black Spruce/Feathermoss Forest Map Unit was assessed at 79% producers' accuracy (confidence interval 65-93%) and 85% users' accuracy (confidence interval 72-98%). Errors in producers' accuracy were primarily associated with Map Units JPF and SFA. Users' accuracy is considered adequate as mapped.

SF - Spruce-Fir Mountain Maple Forest

Photo credit: Michael Lew-Smith

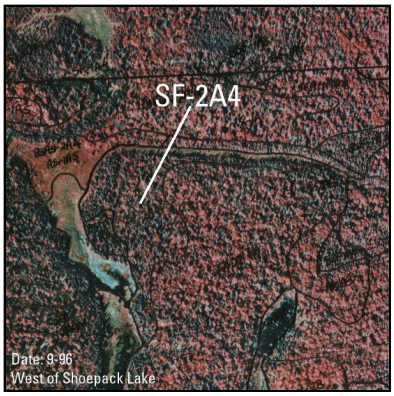
The Spruce-Fir/Mountain Maple Forest Map Unit (SF) represents the Spruce-Fir / Mountain Maple Forest Association. The Balsam Fir - Paper Birch Forest Association is very rare and most likely is mapped with SF where it exists. The Spruce-Fir / Mountain Maple Forest Association most commonly occurs on gentle to moderate slopes above wetlands and lakeshores. Aspects are variable. Soils are generally well drained sandy loams. The canopy can be fairly open (40-70%) and composed predominantly of white spruce and balsam fir with lesser amounts of black spruce.

SF-2A4 appears as dark blue with a fine nubby texture. The canopy is open and evenly dispersed. The tree height falls between 5-12 meters. The photo was taken in September 1995.

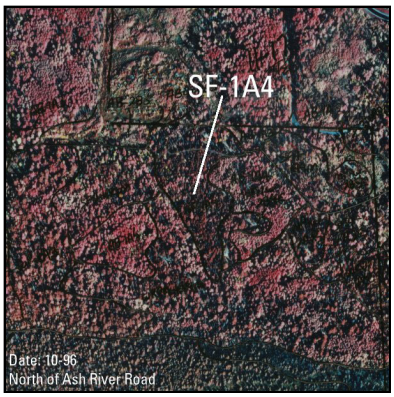


SF - Spruce-Fir Mountain Maple Forest

SF-2A4 appears as dark blue and gray with speckles of red and a medium rough texture. The dark blue and gray is mostly fir with some spruce and the red is scattered aspen. The once established aspen has declined due to blowdown. The canopy is open and evenly dispersed. The tree height falls between 5-12 meters. The photo was taken in September 1996.



SF-1A4 appears as dark red with a fine texture. The canopy is continuous and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in October 1996.



SF-2D5 appears rusty-red and fine textured. The canopy is open and regularly alternating. Because of recent logging, the trees are short (<0.5 meters). When the coverage pattern is regulating alternating for the SF Map Unit, regardless of height, this is indication of silvaculture, a practice that is occasional outside the park. The photo was taken in October 1996.

Area Report for SF Map Unit
Polygons: 1,167
Hectares: 1,958
Acres: 4,838
Average size: 2 hectares, 4 acres

Accuracy Assessment Results for SF Map Unit
The Spruce-Fir/Mountain Maple Forest Map Unit was assessed at 92% producers' accuracy (confidence interval 80-103%) and 79% users' accuracy (confidence interval 64-93%). Producers' accuracy is considered adequate as mapped. Errors in users' accuracy were primarily associated with Map Units BSF and SFA.

AB - Quaking Aspen-Paper Birch Forest

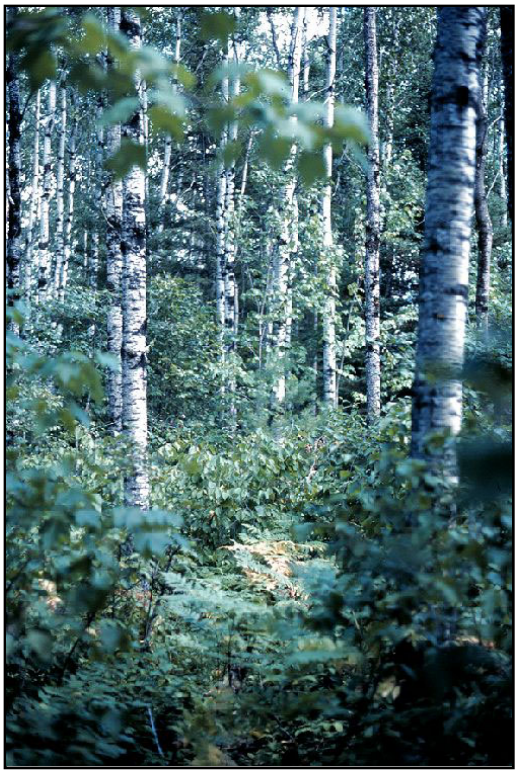


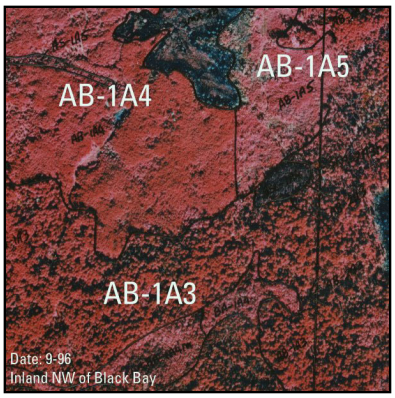
Photo credit: Michael Lew-Smith

Photo credit: Michael Lew-Smith

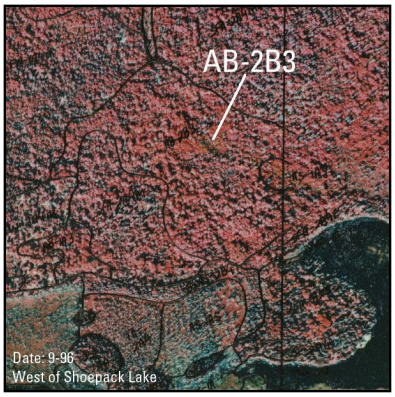
The Quaking Aspen-Paper Birch Forest Map Unit (AB) represents two associations within the Quaking Aspen - Paper Birch Forest Alliance: Aspen Birch/Boreal Conifer Forest and Aspen - Birch - Red Maple Forest. These associations are also included in the JPAX Map Unit when they occur as a mosaic pattern with the Jack Pine / Balsam Fir Forest Association (see description for JPAX). And, they are also included in the WRPA Map Unit when they occur as a mosaic pattern with either one or both the White Pine/Mountain Maple Mesic Forest Association and the Red Pine/Blueberry Dry Forest Association (see description for WRPA).

The Aspen/Birch / Boreal Conifer Forest Association is one of the most abundant and widespread types occurring from well drained ridges to lower areas. It includes young forests to mature stands, typically dominated by quaking aspen with paper birch and big tooth aspen common. The tree sub-canopy includes conifers along with red maple. The Aspen - Birch - Red Maple Forest Association is not as common and is more localized throughout the area. Although similar to the former, this association lacks the conifers in the tree sub-canopy with the red maple remaining present. Regardless of association, open canopies due to blowdown situations are fairly common.

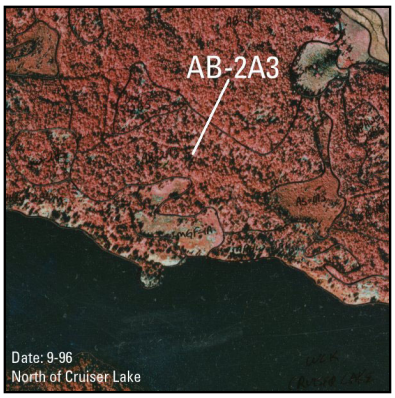
AB exhibits different signatures based on stand age. AB-1A3 appears orange-red with small patches of very dark red and a somewhat choppy texture. The canopy is continuous and evenly dispersed. The orange-red is aspens and birch, and the dark red is fir in the tree sub-canopy. AB-1A4 appears bright orange-red with a more sculptured carpet-like texture. AB-1A5 appears pink for the young aspen with lighter pink patches revealing the herbaceous layer. The photo was taken in September 1995.



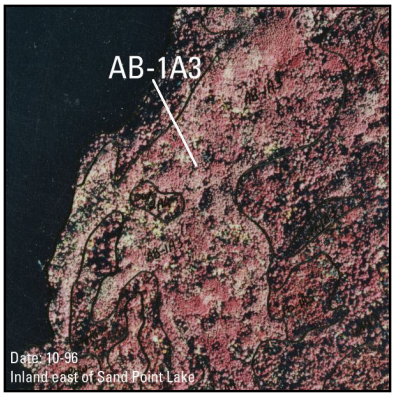
AB - Quaking Aspen-Paper Birch Forest



AB-2B3 appears as red and orange-red with dots of blue. The texture is somewhat choppy. The orange-red is the aspen and the blue dots are mostly balsam fir. The canopy is open and clumped due to blowdown. The tree height falls within the 12-20 meter range. The photo was taken in September 1996.



AB-2A3 appears as red and orange-red with scattered dark red spots. The canopy is open and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in September 1996.



AB-1A3 appears as red and pink with a few splotches of yellow and very dark red. The texture is carpet-like to choppy in places. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in October 1996.

Area Report for AB Map Unit
Polygons: 3,361
Hectares: 21,696
Acres: 53,613
Average Size: 6 hectares, 16 acres

Accuracy Assessment Results for AB Map Unit
The Quaking Aspen-Paper Birch Forest Map Unit was assessed at 65% producers' accuracy (confidence interval 52-77%) and 84% users' accuracy (confidence interval 72-95%). Errors in producers' accuracy were primarily associated with Map Unit ABW, AL, and SFA. Users' accuracy is considered adequate as mapped.

PB - Paper Birch/Fir Forest

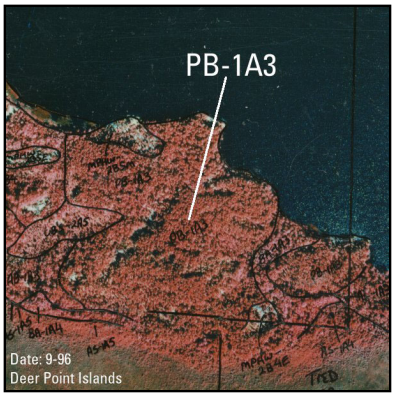
Photo credit: Michael Lew-Smith

Photo credit: Kevin Hop

The Paper Birch/Fir Forest Map Unit (PB) represents the Paper Birch / Fir Forest Association. Large stands of this association are known from only one location; Deer Point Islands in Voyageurs National Park. Smaller, isolated patches of this forest, however, can be found scattered throughout the park

This association occurs on flat terrain or gentle slopes with variable aspects. Soils are shallow sandy loams usually 3-10 cm deep over bedrock. Paper birch is frequently the only tree species in the canopy. Lesser amounts of quaking aspen or balsam fir may be present in some stands. Hazelnut is the dominant shrub and either occurs in dense colonies (60-80% cover) or in scattered patches (5-25% cover). Paper birch is difficult to distinguish from aspen from the aerial photographs.

PB-1A3 appears as red-orange with a carpet-like texture. The canopy is continuous and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in September 1996



PB - Paper Birch/Fir Forest

Area Report for PB Map Unit
Polygons: 4
Hectares: 21
Acres: 52
Average Size: 5 hectares, 13 acres

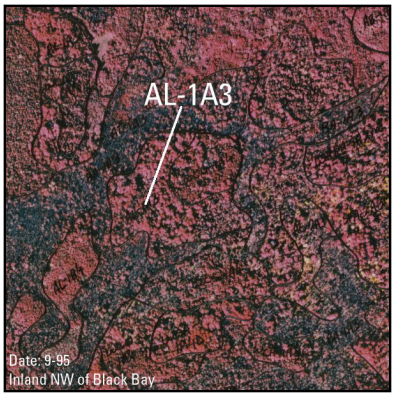
Accuracy Assessment Results for PB Map Unit
The Paper Birch/Fir Forest Map Unit was assessed at 80% producers' accuracy (confidence interval 41-119%) and 100% users' accuracy (confidence interval 88-113%).

AL - Trembling Aspen-Balsam Poplar Lowland Forest

Photo credit: Michael Lew-Smith

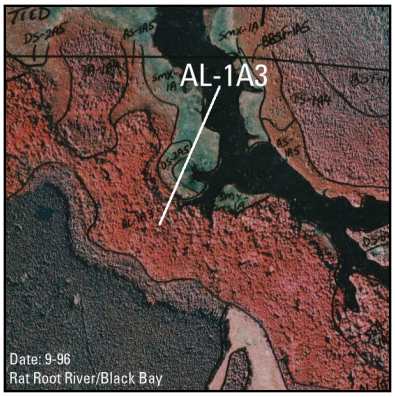
The Trembling Aspen-Balsam Poplar Lowland Forest Map Unit (AL) represents the Aspen - Balsam Poplar Lowland Forest Association. This association is most common in the southwest portion of the project area where the terrain is relatively flat and poorly drained soils are more common. It also occurs elsewhere in areas surrounded by upland, in drainage courses, and adjacent to lakes. The soils are generally poorly drained. The canopy consists of trembling aspen and balsam poplar. Black ash can occasionally reach the canopy as well.

AL-1A3 appears bright pink with dark blue splotches and a somewhat rough texture. The canopy is closed and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in September 1995.



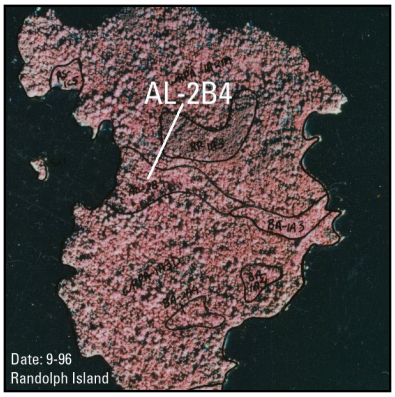
AL - Trembling Aspen-Balsam Poplar Lowland Forest

AL-1A3 appears as orange-red with a carpet-like texture. The canopy is continuous and evenly dispersed. The tree height falls within the 12-20 meter range. The photo was taken in September 1996.



AL-1B4 appears deep pink with dots of light tan. The texture is nubby and carpet-like. The canopy is closed and clumped. The tree height falls within the 5-12 meter range. The photo was taken in October 1996.

Al-2B4 appears as pink with orange-red patches and a choppy texture. The pink is the aspen and the orange-red is the shrub and herbaceous layer in the understory. The canopy is open and clumped. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.



Area Report for AL Map Unit
Polygons: 1,261
Hectares: 3,155
Acres: 7,797
Average Size: 3 hectares, 6 acres

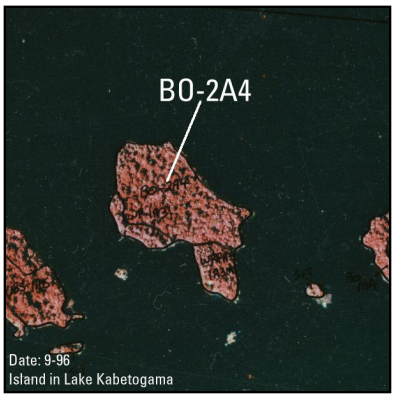
Accuracy Assessment Results for AL Map Unit
The Trembling Aspen-Balsam Poplar Lowland Forest Map Unit was assessed at 75% producers' accuracy (confidence interval 57-93%) and 63% users' accuracy (confidence interval 44-81%). Errors in users' accuracy were primarily associated with Map Unit AB.

BO - Northern Bur Oak Mesic Forest

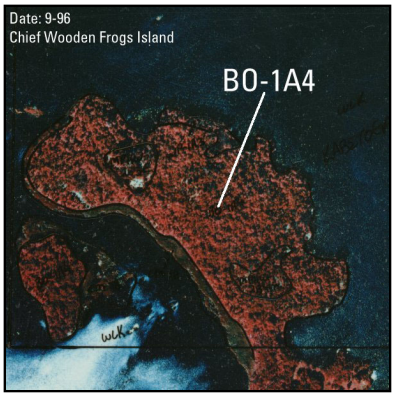
Photo credit: Michael Lew-Smith

The Northern Bur Oak Mesic Forest Map Unit (BO) represents the Northern Bur Oak Mesic Forest Association. This association occurs on level to gently sloping terrain with variable aspects. It is most common on dry-mesic to mesic sites on islands or peninsulas. Soils are loams or sandy loams and can be shallow or relatively deep. The canopy is typically dominated by bur oak with green ash or basswood present at low cover or absent. In some circumstances, green ash or basswood may dominate the canopy to the near exclusion of bur oak. Ancillary photographs from 1988 were used to help determine this association from other deciduous forest and woodland types.

BO-2A4 appears red-orange with a rough texture. The canopy is open and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.



BO - Northern Bur Oak Mesic Forest



BO-1A4 appears as red-orange and dark red with a rough texture. The canopy is continuous and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.

Area Report for BO Map Unit
Polygons: 83
Hectares: 156
Acres: 384
Average Size: 2 hectares, 5 acres

Accuracy Assessment Results for BO Map Unit
The Northern Bur Oak Mesic Forest Map Unit was assessed at 93% producers' accuracy (confidence interval 84-102%) and 93% users' accuracy (confidence interval 84-102%).

Planted/Cultivated Vegetation (USNVC) Map Units

A total of 3 map units represent formation level types within the U.S. National Vegetation Classification (USNVC). Because of the way the vegetation has been manipulated by human practices, these formations are listed under Planted/Cultivated Subgroups and are not considered as natural/semi-natural vegetation. No association or alliance level types have been developed for these formations.

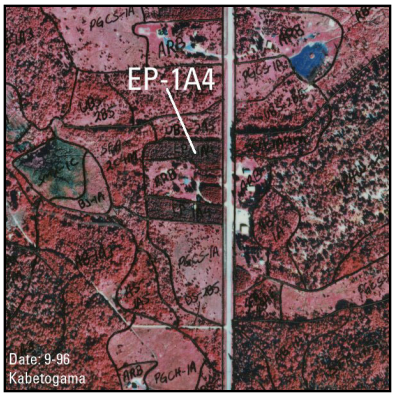
The following lists the USNVC Planted/Cultivated Formations (with USNVC codes in front) that are used for this project along with their corresponding map unit codes:

I.A.8.C.a Evergreen Plantation (*Map Unit Code EP*)
V.A.5.C.a Perennial Grass Crops (hayland, pastureland) (*Map Unit Code PGCH*)
V.A.7.C.a Perennial Grass Crops with Sparse Shrubs (hayland, pastureland) (*Map Unit Code PGCS*)

EP - Evergreen Plantation

The Evergreen Plantation Map Unit (EP) represents the Evergreen Plantation Formation within the USNVC. Evergreen plantations near the park consist mainly of white spruce, red pine, or some mixture thereof. They are typically grown for shelterbelts around farmsteads. All polygons mapped as EP are located outside the park.

EP-1A4 appears as a rectangle of dark purple with a consistent nubby texture. This stand is a shelterbelt of white spruce. The rows of conifer trees are evident under the stereoscope. The redder trees just below are planted red pine, but are mapped as part of the farmstead complex to its side. The canopy coverage is continuous and the pattern is evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.



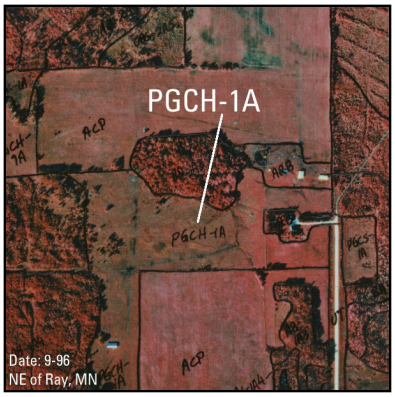
Area Report for EP Map Unit
Polygons: 4
Hectares: 4
Acres: 10
Average size: 1 hectares, 2 acres

USNVC Hierarchy for EP Map Unit	
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Evergreen forest (I.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen forest (I.A.8)
PHYSIOGNOMIC SUBGROUP	Planted/Cultivated (I.A.8.C)
FORMATION	Evergreen Plantation (I.A.8.C.a)

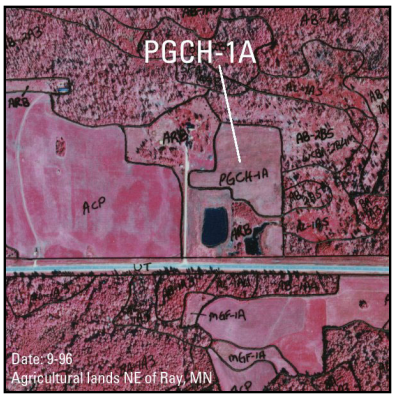
PGCH - Perennial Grass Crops (hay, pastureland)

The Perennial Grass Crops (hay, pastureland) Map Unit (PGCH) represents the Perennial grass crops (hayland, pastureland) Formation within the USNVC. Perennial grass crops are herbaceous lands used primarily for haying and pasturing. Perennial grasses along with a mix of forbs are allowed to grow naturally and dominate the herbaceous layer. Scattered shrubs and trees may be present, but with <10% total cover of each. All polygons mapped as PGCH are located outside the park.

PGCH-1A appears gray-olive and orange with a smooth texture. Cultivated hay fields and deciduous forests surround this grass crop field. The herbaceous coverage is continuous and evenly dispersed. The photo was taken in September 1996.



PGCH-1A appears very light pink to nearly white with a smooth texture. The coverage is continuous and evenly dispersed. The photo was taken in September 1996.



Area Report for PGCH Map Unit
Polygons: 39
Hectares: 164
Acres: 406
Average size: 4 hectares, 10 acres

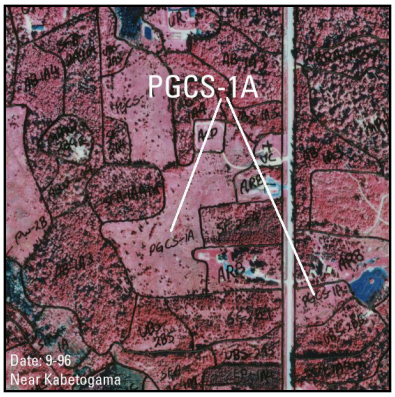
USNVC Hierarchy for PGCH Map Unit

PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoids vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Planted/Cultivated (V.A.5.C)
FORMATION	Perennial grass crops (hayland, pastureland) (V.A.5.C.a)

PGCH - Perennial Grass Crops with Sparse Shrubs (hay, pastureland)

The Perennial Grass Crops with Sparse Shrubs (hay, pastureland) Map Unit (PGCH) represents the Perennial grass crops with a sparse shrub layer (hayland, pastureland) Formation within the USNVC. Perennial grass crops are herbaceous lands used primarily for haying and pasturing, yet are not cultivated to annual type crops. Perennial grasses along with a mix of forbs are allowed to grow naturally and dominate the herbaceous layer. Shrubs, both evergreen and deciduous make up 10-25% of the total cover. PGCS is similar to the PGCH Map Unit, except the higher cover of shrubs. Trees may be present, but normally <10% total cover. All polygons mapped as PGCS are located outside the park. The physiognomic modifiers represent the herbaceous layer of PGCS, and not the shrubs.

PGCS-1A appears light pink with a smooth texture. Dark and light red dots of shrubs are scattered throughout the polygon. The coverage is continuous and evenly dispersed. The photo was taken in September 1996.



Area Report for PGCS Map Unit
Polygons: 45
Hectares: 150
Acres: 370
Average size: 3 hectares, 8 acres

USNVC Hierarchy for EP Map Unit

PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoids vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland with sparse shrubs (V.A.7)
PHYSIOGNOMIC SUBGROUP	Planted/Cultivated (V.A.7.C)
FORMATION	Perennial grass crops with a sparse shrub layer (hayland, pastureland) (V.A.7.C.a)

Land Use/Land Cover Map Units

Eight map units represent classes within the land use/land cover (LUC) classification system developed by Anderson et al. (1976). This classification is designed to meet the needs of Federal and State agencies for a uniform categorization of data from satellite and aircraft remote sensors. It is built on a hierarchical system of 4 levels to fit the classifying needs from satellite type sensor data (Level I) to low-altitude photo imagery data (level IV; <1:20,000-scale).

The Level II of this LUC classification system is used to represent LUC situations for the mapping project. Although the set of photographs used for the mapping is of a scale of 1:15,840, Level II is used as the Program's standard. LUC Level II classes are used for map units not classified by the USNVC Natural/Semi-natural or Planted/Cultivated types, such as populated areas, roads, agricultural lands, quarries, and open water bodies that are <10% vegetated. Eight LUC Level II classes were used to represent these situations. Although 8 LUC classes are represented directly by map units, all LUC classes are built into the spatial database map within a crosswalk field to all map units. Only those 8 LUC classes that are not classified by USNVC or other park specific map classes are discussed here. For full documentation of all LUC classes, refer to the classification system (Anderson et al.).

The following lists the Level II classes (with LUC codes in front) that are used for this project along with their corresponding map unit codes:

1 Urban or Built-up Land
- 11 Residential (*Map Unit Code UR*)
- 12 Commercial and Services (*Map Unit Code UC*)
- 14 Transportation, Communications, and Utilities (*Map Unit Code UT*)

2 Agricultural Land
- 21 Cropland and Pasture* (*Map Unit Code ACP*)
- 22 Other Urban or Built-up Land (*Map Unit Code ARB*)

5 Water
- 51 Streams and Canals (*Map Unit Code WS*)
- 52 Lakes** (*Map Unit Code WLK*)

7 Barren Land
- 75 Strip Mines, Quarries, and Gravel Pits (*Map Unit Code BLQ*)

* Although Cropland and Pasture is currently within the USNVC, monotypic agriculture vegetation was in the initial stages of development. With the LUC Level II classification being a standardized classification firmly in place, it was decided to keep the ACP Map Unit representation as it was.

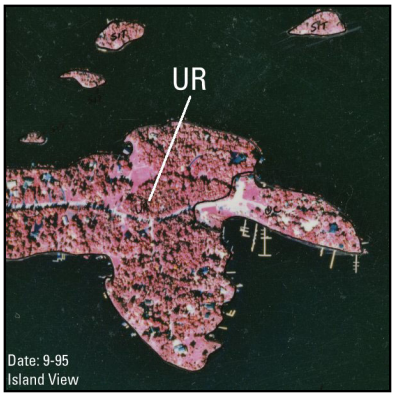
** Water levels of all the large lakes, including Rainy, Kabetogama, Namakan, and Sand Point Lakes, are affected to some degree by water control structures. However, the size and irregular shapes of their shorelines give the appearance of natural lakes. Thus, it was decided to use the Level II Lakes (52) Class rather than the Level II Reservoir (53) Class.

UR - Residential

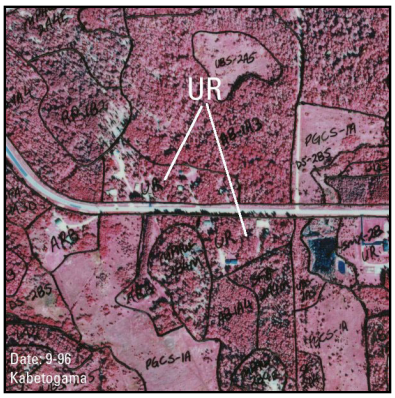
The Residential Map Unit (UR) represents the Residential Level II Class. For this mapping project, it includes lands used primarily for residential use. They consist of residential homes in populated areas and of homesteads in rural settings but are not part of farmsteads. Although most polygons mapped as UR are outside the park boundary, a few are found within.

UR in this photo appears as several scattered houses along the bay. Smooth pink lawns and scattered trees are visible.

UR appears as scattered houses, lawns, and small wooded areas between residences. White roads are also visible.



UR appears as a residential area along either side of a road.



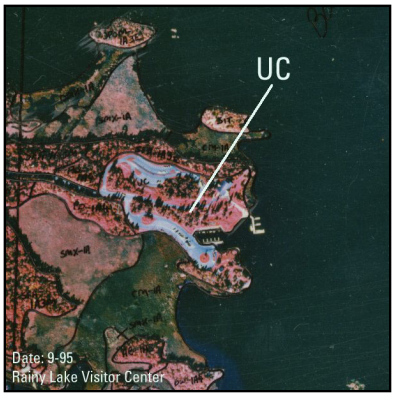
Area Report for UR Map Unit
Polygons: 179
Hectares: 269
Acres: 664
Average size: 2 hectares, 4 acres

Land Use/Land Cover Classification Hierarchy for UR Map Unit
LEVEL I Urban or Built-up Land (1)
LEVEL II Residential (11)

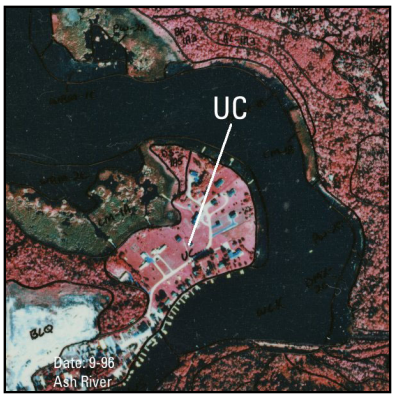
UC - Commercial and Services

The Commercial and Services Map Unit (UC) represents the Commercial and Services Level II Class. For this mapping project, it includes lands used primarily for commercial purposes. They consist of resorts, restaurants, convenient stores, and park visitor centers.

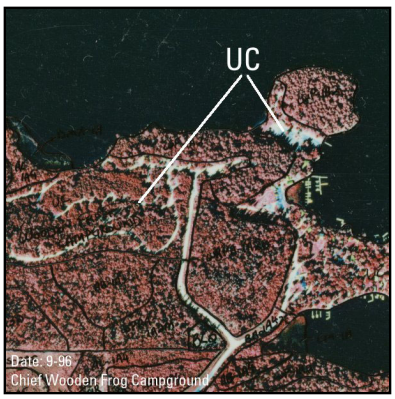
UC appears light blue and pink with darker red conifer trees. The parking lot is clearly visible and the vegetation appears park like with grass and trees. 47 polygons covering 210 hectares of UC were mapped for the project.



UC appears pink with blue buildings and white roads visible. This is a residential and commercial area, with grass, a few scattered trees, homes and commercial buildings.



UC appears as red conifers with openings. A road loops around a campground where individual campsites are visible.



Area Report for UC Map Unit
Polygons: 47
Hectares: 210
Acres: 519
Average size: 4 hectares, 11 acres

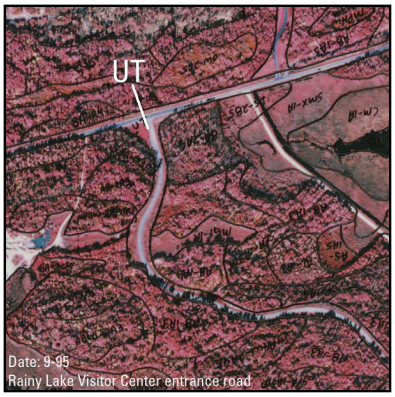
Land Use/Land Cover Classification Hierarchy for UC Map Unit

LEVEL I	Urban or Built-up Land (1)
LEVEL II	Commercial and Services (12)

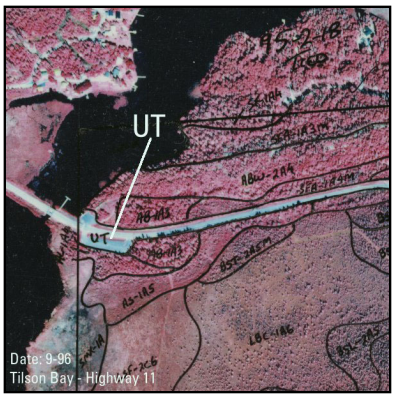
UT - Transportation, Communications, and Utilities

The Transportation, Communications, and Utilities Map Unit (UT) represents the Transportation, Communications, and Utilities Level II Class. For this mapping project, it includes roads and their right-of-ways, roadside parking areas, and railroads. Most polygons mapped as UT are outside the park boundary, with only a few reaching into the park for access purposes. Only the more major road structures are mapped, leaving out small narrow roads and trails. Roads within polygons mapped as Residential (UR) or Commercial and Services (UC) become a part of those polygons and are not delineated out separately. Examples of polygons mapped as UT are U.S. Highway 53, State Highways 3 and 11, the Ash River Trail Road, and a network of roads in and around Kabetogama Village.

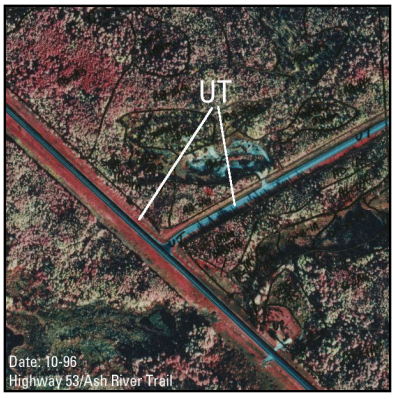
UT in this photo is of a paved road with herbaceous vegetation along the roadside, which appears as orange and pink edges.



UT in this photo is of a highway and a roadside parking area.



UT has a thick band of red, which is vegetation within the highway's right-of-way.



Area Report for UT Map Unit
Polygons: 4
Hectares: 284
Acres: 702
Average size: 71 hectares, 175 acres

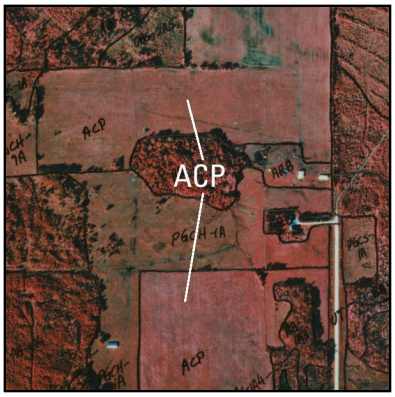
Land Use/Land Cover Classification Hierarchy for UT Map Unit

LEVEL I	Urban or Built-up Land (1)
LEVEL II	Residential (11)

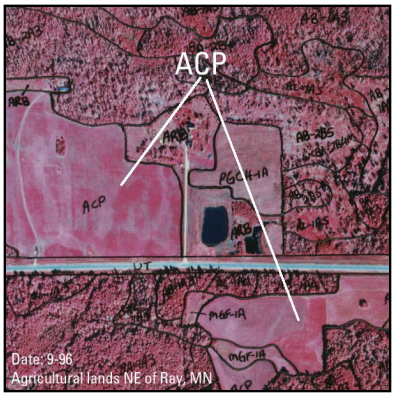
ACP - Cropland and Pasture

The Cropland and Pasture Map Unit (ACP) represents the Cropland and Pasture Level II Class. For this mapping project, it includes lands cultivated for crops or improved pasture with monotypic annual or biennial herbaceous vegetation. All polygons mapped as ACP are located outside the park. No physiognomic modifiers are used with ACP.

ACP appears as a mottled pinkish orange with a smooth texture. A slight streaking gives evidence of the periodic haying.



ACP appears as bright and pale pink with a smooth texture.



Area Report for ACP Map Unit
Polygons: 31
Hectares: 200
Acres: 494
Average size: 6 hectares, 16 acres

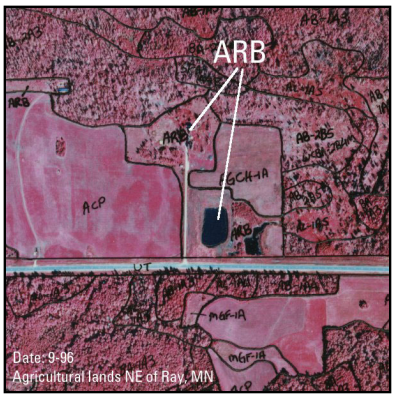
Land Use/Land Cover Classification Hierarchy for ACP Map Unit

LEVEL I	Agricultural Land (2)
LEVEL II	Cropland and Pasture (21)

ARB - Other Agriculture Land

The Other Agriculture Land Map Unit (ARB) represents the Other Agriculture Land Level II Class. For this mapping project, it includes lands utilized by farmsteads and includes buildings and farm ponds. All polygons mapped as ARB are located outside the park.

ARB in this photo refers to the farmstead and farm ponds with scattered shrubs and mowed vegetation.



Area Report for ARB Map Unit
Polygons: 58
Hectares: 78
Acres: 192
Average size: 1 hectares, 3 acres

Land Use/Land Cover Classification Hierarchy for ACP Map Unit
LEVEL I Agricultural Land (2)
LEVEL II Other Agriculture Land (22)

WS - Streams and Canals

The Streams and Canals Map Unit (WS) represents the Streams and Canals Level II Class. For this mapping project, WS maps only the portions of rivers and streams that are <10% vegetated. River and stream portions that have >10% vegetation are described with map units that represent the vegetation. The Anderson et al. (1976) uses the Bureau of Census' definition of water and defines it as areas persistently covered with water, being >200 m wide if linear, and covers at least 16 h of area. However, some streams are mapped <200 m wide, with the narrowest being 10 m. Also, due to the challenges in drawing polygons around narrow streams, some stretches of streams are delineated only when wide enough (e.g. East Branch Rat Root River). Thus the average polygon size and the number of streams mapped is misrepresented by the information in the area report below.

Examples of streams and rivers mapped as WS are Gold Portage, Ash River, Moose River, Rollick Creek, and East Branch Rat Root River.

WS appears as a straight black watercourse in this photo. Dense stands of cattail are adjacent each side. The width of this stream is about 25 m.

WS appears as a straight black watercourse in this photo. Boat docks from resorts are visible along one side of the river. The width of the river at this location is about 70 m.

Area Report for WS Map Unit
Polygons: 10
Hectares: 97
Acres: 240
Average size: 10 hectares, 24 acres

Land Use/Land Cover Classification Hierarchy WS Map Unit
LEVEL I Water (5)
LEVEL II Streams and Canals (51)

WLK - Lakes

The Lakes Map Unit (WLK) represents the Lakes Level II Class. For this mapping project, WLK maps the portions of lakes that are <10% vegetated. Lake areas (such as bays and shorelines) that have >10% vegetation are described with map units that represent the vegetation. The Anderson et al. (1976) uses the Bureau of Census' definition of water, which is defined as areas persistently covered with water, >200 m wide if linear, and covers at least 16 h. Water bodies (<10% vegetated) that are <16 h are mapped with other park specific map units (see descriptions for WBP and WNP).

The WLK Map Unit is used for Rainy, Kabetogama, Namakan, and Sand Point Lakes. It is noted that the water levels of these large lakes are affected to some degree by water control structures. However, the size and irregular shapes of their shorelines give the appearance of natural lakes. Thus, it was decided to use the Level II Lakes (52) Class rather than the Level II Reservoir (53) Class. Examples of natural lakes mapped as WLK are Wiyapka Lake (20 h), the chain lakes; Locator, War Club, Quill, and Loiten Lakes (range of 32 to 52 h), and Johnson Lake (680 h).

WLK appears as black with a smooth, flat texture. There is no evidence of aquatic plants visible at the surface. This bay is within Rainy Lake, one of the large lakes affected to some degree by a water control structure.

WLK appears as black with a smooth, flat texture. This lake is about 49 h in size.

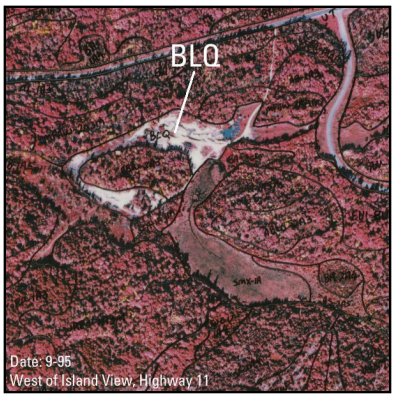
Area Report for WLK Map Unit
Polygons: 40
Hectares: 53,347
Acres: 131,824
Average size: 1334 hectares, 3296 acres

Land Use/Land Cover Classification Hierarchy for WLK Map Unit

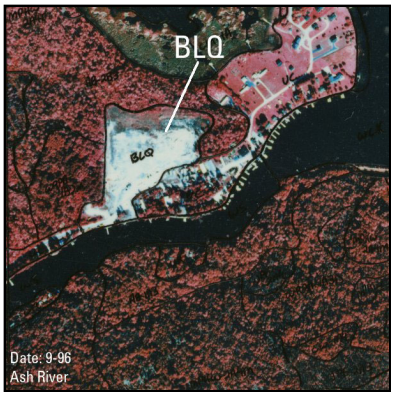
LEVEL I	Water (5)
LEVEL II	Lakes (52)

BLQ - Strip Mines, Quarries, and Gravel Pits

The Strip Mines, Quarries, and Gravel Pits Map Unit (BLQ) represents the Strip Mines, Quarries, and Gravel Pits Level II Class. It includes lands used for extractive mining purposes, including recent non-active quarries. All polygons mapped as BLQ are located outside the park.



BLQ appears as mostly white with patches of reddish-pink and blue. The smooth white is exposed surface within this active gravel pit. The reddish-pink is shrubs and herbaceous, with the triangle shaped blue being a small pond associated with the gravel pit.



BLQ appears as mostly white with shades of gray due to sun angle and shadow in this photo. The texture is very smooth.

Area Report for BLQ Map Unit
Polygons: 16
Hectares: 74
Acres: 184
Average size: 5 hectares, 11 acres

Land Use/Land Cover Classification Hierarchy BLQ Map Unit

LEVEL I	Barren Land (7)
LEVEL II	Strip Mines, Quarries, and Gravel Pits (75)

Small Islands and Natural Ponds Map Units

Photo credit: Kevin Hop

Six map units represent land cover features that do not fit in either the USNVC or the land use/land cover classification system developed by Anderson et al. (1976). These are split into two groups: Small Islands and Small Natural Ponds.

There are 4 map units that represent small upland islands >0.1 h in size, but less than the standard minimum mapping unit of 0.5 h. These islands are located within large open lakes, shallow bays, shrub and herbaceous wetlands, and peatlands. Because of their small size, the USNVC is not ideal from either a field or a photo perspective.

The Small Islands Map Units are as follows:

Small Island with Grass (*Map Unit Code SIG*)
Small Island with Rock (*Map Unit Code SIR*)
Small Island with Shrubs (*Map Unit Code SIS*)
Small Island with Trees (*Map Unit Code SIT*)

There are 2 map units that represent small natural ponds. These ponds are water bodies that are <10% vegetated and are <16 h in size. These small ponds do not fall within the Lakes (52) Class in the LUC classification system (Anderson et al), but rather within the Nonforested Wetland (62) Class. (Water, as defined in the classification system, uses the Bureau of Census' definition, which is defined as areas persistently covered with water, >200 m wide if linear, and covering at least 16 h.) The Nonforested Wetland Class was not used because this class includes vegetated types. The 2 map units were created to separate ponds that are affected by beaver activity from ponds that are not. Because of limitations in seeing submergent vegetation with CIR aerial photographs, some of these small ponds may indeed have >10% vegetation. In such cases, these polygons would best be described within the Midwest Pondweed Submerged Aquatic Wetland Association of the USNVC. Bodies of water (<10% vegetated) that are >16 h are mapped with the Streams and Canals or Lakes Map Units (see descriptions for WS and WLK).

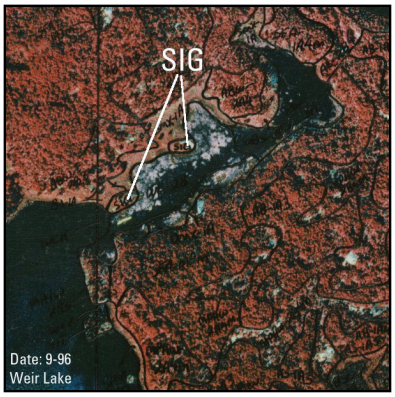
The Small Natural Ponds Map Units are as follows:

Water-Beaver Pond (*Map Unit Code WBP*)
Water-Natural Pond (*Map Unit Code WNP*)

SIG - Small Island with Grass

The Small Island with Grass Map Unit (SIG) represents small upland islands that are dominated by grasses and forbs. These islands are >0.1 h in size, but less than the standard minimum mapping unit of 0.5 h. Trees and shrubs may be present, but at low cover (<25%). They are typically located within large open lakes, shallow bays, and herbaceous wetlands.

Two SIG polygons appear on this photo as an orange-red herbaceous layer. Deep and shallow wetlands surround these small islands.



Area Report for SIG Map Unit
Polygons: 11
Hectares: 1
Acres: 3
Average size: 0.1 hectares, 0.3 acres

SIR - Small Island with Rock

The Small Island with Rock Map Unit (SIR) represents small upland islands that are dominated nonvascular lichens and mosses over exposed bedrock. These islands are >0.1 h in size, but less than the standard minimum mapping unit of 0.5 h. Trees, shrubs, and herbaceous vegetation may be present, but at low cover (<25%). These islands are typically located within large open lakes where exposures to harsh environments limit the growth of vascular vegetation. Occasionally, they are located within herbaceous wetlands. They are identified on the photos by the pale bluish-white color that is reflectance from the exposed bedrock surface.

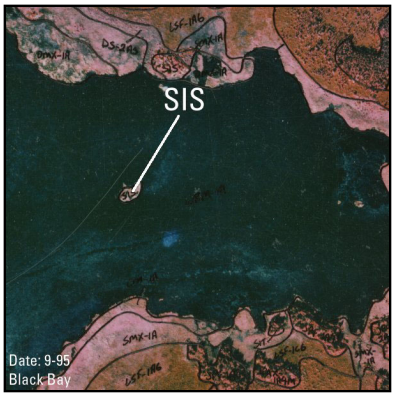
SIR appears as a pale bluish-white with a smooth texture. A small red dot is located in the middle of the polygon (just under the pointer), which is a small clump of vegetation.

Area Report for SIR Map Unit
Polygons: 58
Hectares: 6
Acres: 14
Average size: 0.1 hectares, 0.2 acres

SIS - Small Island with Shrubs

The Small Island with Shrubs Map Unit (SIS) represents small upland islands that are dominated by shrubs. These islands >0.1 h in size, but less than the standard minimum mapping unit of 0.5 h. The shrubs may be evergreen, deciduous, or mixture thereof, with a total coverage of >25%. Trees may be present, but at low cover (<25%). An herbaceous layer is usually present. They are typically mapped within shallow bays, herbaceous wetlands, and peatlands. Occasionally, they are located within large open lakes.

SIS appears as pinks with a relatively smooth texture (appearance obscured by the map attribute label). This small island is within a large bay that is dominated by wild rice.



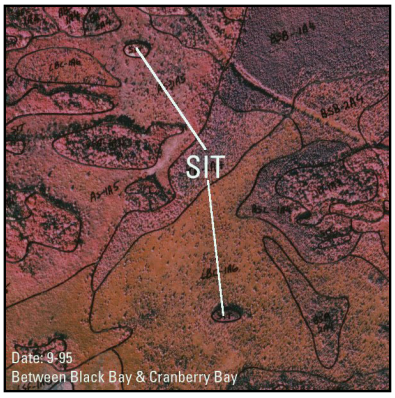
Area Report for SIS Map Unit
Polygons: 128
Hectares: 16
Acres: 39
Average size: 0.1 hectares, 0.3 acres

SIT - Small Island with Trees

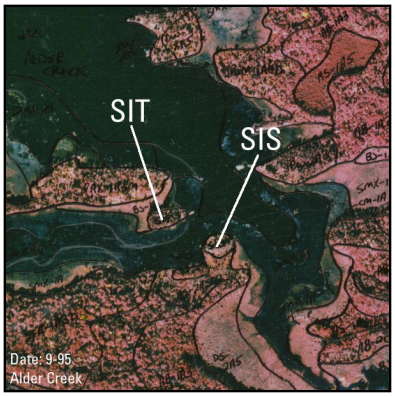
The Small Island with Trees Map Unit (SIT) represents small upland islands that are dominated by trees, either forest or woodland. These islands are >0.1 h in size, but less than the standard minimum mapping unit of 0.5 h. The trees may be evergreen, deciduous, or mixture thereof, with a total coverage of >25%. The tree canopy may be closed or open. A shrub and herbaceous layer is usually present. They are typically mapped within bays of large lakes, herbaceous wetlands, and peatlands. When located within large open lakes, they are usually in close proximity to land. Of all the Small Islands Map Units, SIT is most common.

SIT appears as dark and light purples, red, and tinge of yellow. These color mixes are due to a mix of evergreen and deciduous trees on this island. This small island is within one of Rainy Lake's bays.

2 SIT polygons are visible in this photo. One is within a large shrubland, the other within a peatland complex.



Both SIT and SIS are visible in this photo. They are located within a sheltered bay surrounded by deep and shallow wetlands.



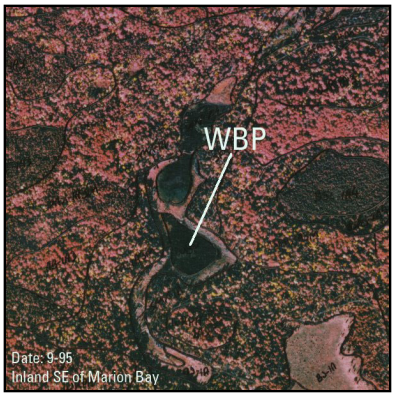
Area Report for SIT Map Unit
Polygons: 855
Hectares: 152
Acres: 375
Average size: 0.2 hectares, 0.4 acres

WBP - Water-Beaver Pond

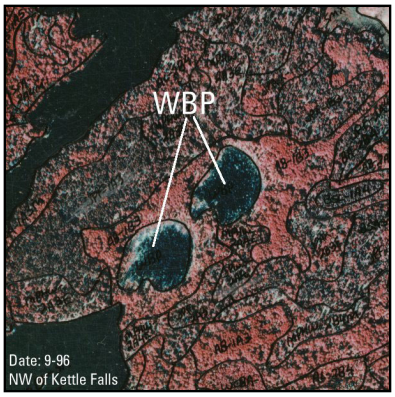
The Water-Beaver Pond Map Unit (WBP) represents small ponds created by beaver activity. WBP is used only for ponds (or portions of ponds) that are <10% vegetated. Beaver ponds (or portions of) that are >10% vegetated are described with map units that represent the type of vegetation present. Thus, WBP does not map all beaver ponds, or even whole beaver ponds. Most WBP polygons are only parts of larger beaver complexes that include several other polygons of herbaceous and shrubland vegetation types. WBP was created to map these ponds separate from other small ponds that *are not* affected by beaver activity (see discussion for WNP). Standing dead trees are common within WBP.

Because of limitations in seeing submergent vegetation with CIR aerial photographs, some of these small ponds may indeed have >10% vegetation. In such cases, these polygons would best be described within the Midwest Pondweed Submerged Aquatic Wetland Association of the USNVC.

WBP appears as black with a smooth, flat texture. Aquatic plants visible are not visible at the surface. This WBP polygon is bordered by a polygon mapped as SMX, all within the same beaver impoundment. This impoundment is just one in a series of beaver impoundments.



WBP appears as black and bluish-white with a smooth and mottled texture. The bluish-white along the edge is standing dead trees due to flooding. There is no evidence of aquatic plants visible at the surface.



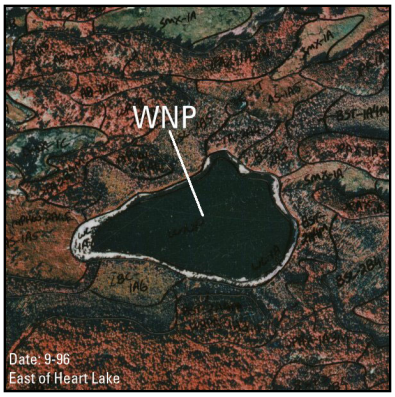
Area Report for WBP Map Unit
Polygons: 52
Hectares: 70
Acres: 173
Average size: 1 hectares, 3 acres

WNP - Water-Natural Pond

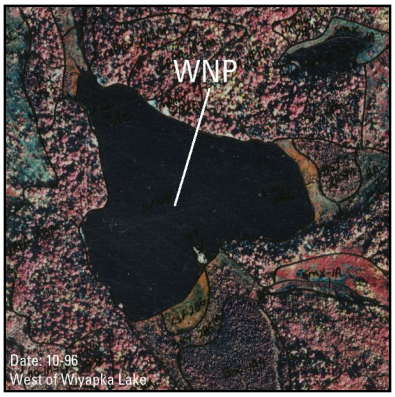
The Water-Natural Pond Map Unit (WNP) represents natural bodies of water that are <16 h in size and *are not* affected by beaver activity. WNP is used only for ponds (or portions of ponds) that are <10% vegetated. Ponds (or portions of) that are >10% vegetated are described with map units that represent the type of vegetation present. WNP does not necessarily map the entire pond. Some WNP polygons are only the open water portion of a pond. Vegetation within shallow bays or along shorelines are mapped separately. WNP was created to map these ponds separate from other small ponds that *are* affected by beaver activity (see discussion for WBP).

Because of limitations in seeing submergent vegetation with CIR aerial photographs, some of these small ponds may indeed have >10% vegetation. In such cases, these polygons would best be described within the Midwest Pondweed Submerged Aquatic Wetland Association of the USNVC.

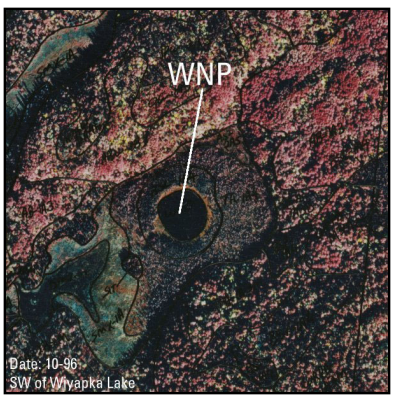
WNP appears as black with a smooth texture. A narrow ring of water lily borders this pond, which is mapped separately with the WL Map Unit. The WNP polygon is 6 h in size. With the WL polygon, the entire pond is almost 8 h.



WNP appears as black with a smooth texture. There is no evidence of aquatic plants visible at the surface. The WNP polygon extends to the shoreline of the pond, with upland forests and shrub fens bordering it.



WNP appears as black with a smooth texture. There is no evidence of aquatic plants visible at the surface. The WNP polygon extends to the shoreline of the pond, which is bordered by a narrow ring of black spruce.



Area Report for WNP Map Unit
Polygons: 21
Hectares: 113
Acres: 279
Average size: 5 hectares, 13 acres